THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXXIII. No. 1878.] LONDON, MAY 9, 1899. [51ST YEAR. PRICE 6d.

WELDON MUD
FOR
GAS PURIFICATION,
For use in the
RECOVERY OF SULPHUR,
ALSO
Removal of last Traces of SULPHURETTED HYDROGEN in catch position.

Full Particulars on application to the Patentees:
GAS DESULPHURIZATION CO.,
— LIMITED, —
1, FENCHURCH AVENUE, LONDON, E.C.

THORNLEY GAS COALS
WORKED BY THE
WEARDALE IRON & COAL Co., Ld.
OUT OF THEIR
THORNLEY AND WHEATLEY HILL COLLIERIES.

Analysis made by
Messrs. J. & H. S. PATTINSON, *May 28, 1895.*

Yield of Gas per Ton . .	10,500 Cub. Ft.
Illuminating Power . . .	16·9 Candles.
Coke (of good quality) . .	67·5 per Cent.
Sulphur	0·58 ,,
Ash	2·73 ,,

For Price, &c., apply to the
WEARDALE IRON & COAL Co., Ld.
QUAYSIDE, NEWCASTLE-ON-TYNE.

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Parker's Imperial Black Varnish,
Oxide Paints, Oils, and General Stores, for Gas and Water Works.
WORKS:
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CANNEL COAL MERCHANT,
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BRASS GAS-FITTINGS, GAS-VALVES, STEAM & WATER VALVES, TOOLS, &c., AND OF
WARNER'S PATENT MARKET GAS STAND-PIPE.
LONDON: LAMBETH BRASS & IRON CO., Ltd., Short St., LAMBETH.

The "DEMAND," REGISTERED. *

BIGGS, WALL, & CO.,
GAS AND WATER ENGINEERS,
13, CROSS STREET, FINSBURY PAVEMENT,
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FULL-WAY MAIN TAPS & LANTERN TAPS.
SEVERAL DESIGNS SHOWN BELOW.

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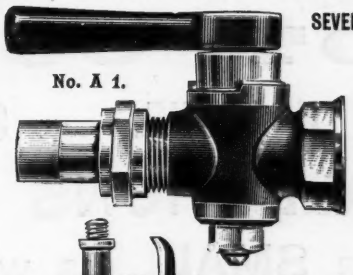
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AS SHOWN.
SUPERIOR QUALITY AND FINISH IN GUN METAL.

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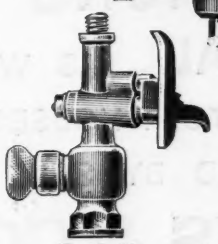
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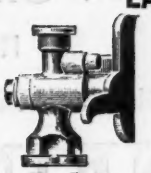
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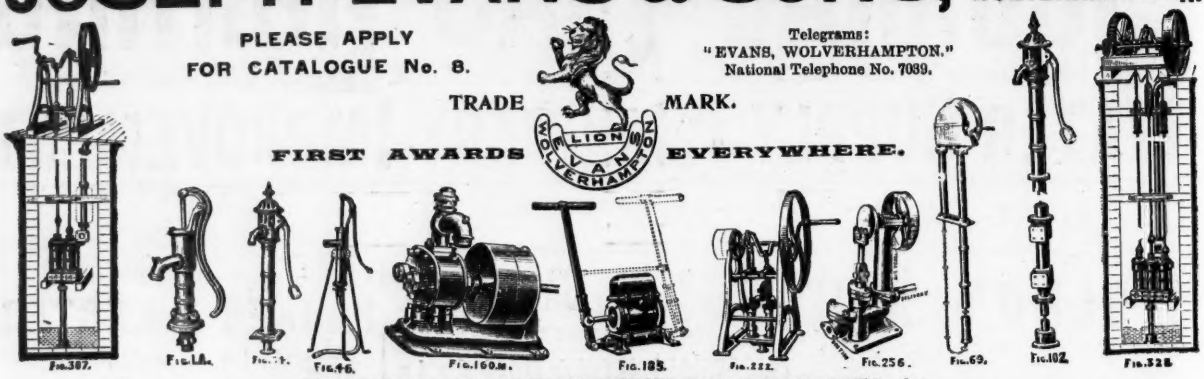

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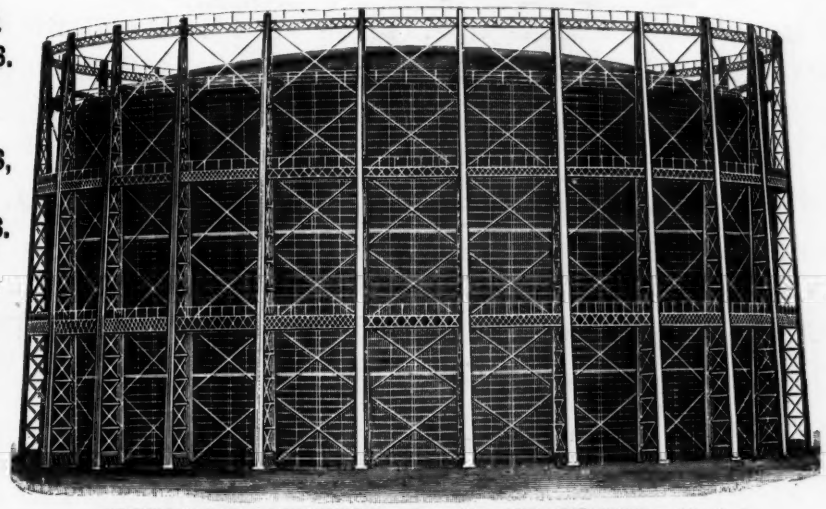

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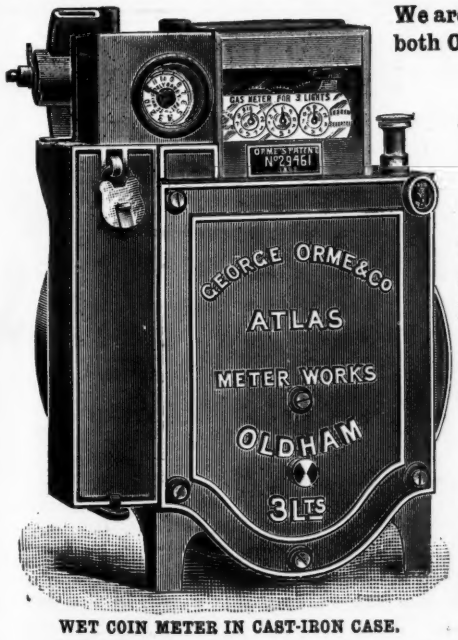

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Improved COAL and COKE HANDLING PLANT, CONVEYORS, and ELEVATORS,

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42 MEDALS AWARDED.

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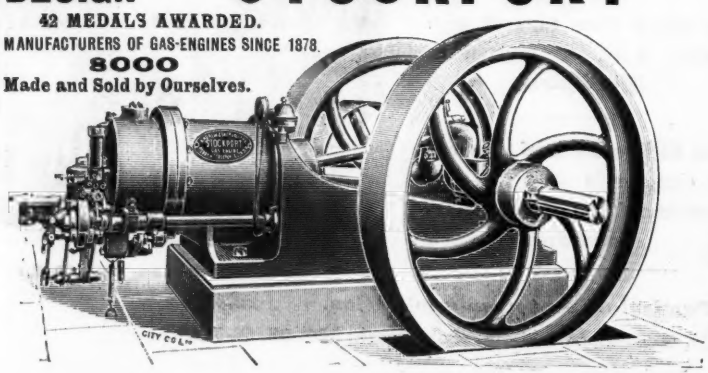

With Otto Cycle and our own Patented Improvements.

All Sizes from 1½ H.P. to 250 Brake H.P.

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The Greatest Brake H.P. given for the Smallest Gas Consumption.

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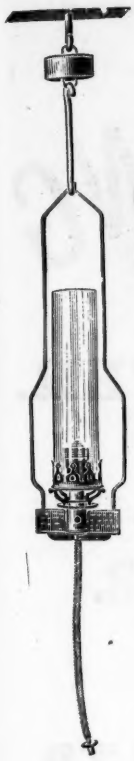

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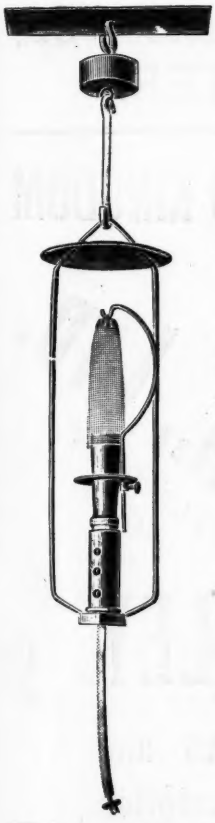
The AVIL System has proved a great success, and has been largely adopted.

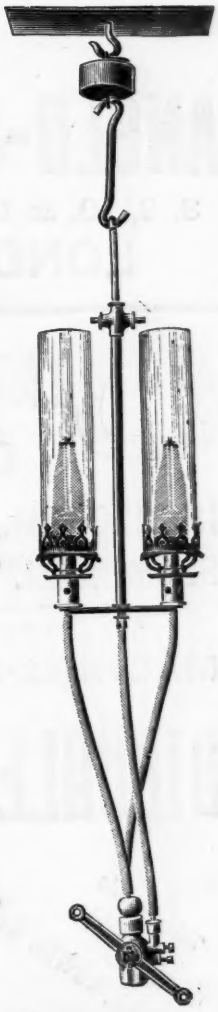
It has been in use in Bradford for over Four Years.



TIME PROVES ALL THINGS;

And it has undoubtedly proved the efficiency of the AVIL System all over the Country.

Testimonials have been received from Bradford, Huddersfield, Coventry, Macclesfield, and many other large Towns and Cities.



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Success Guaranteed in all Positions.

We hold the Original Patents.

For Illustrated Catalogue, apply to

The Anti-Vibration Incandescent Lighting Co., LIMITED,

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Telegrams: "CANDESCENT, BRADFORD."

OIL FOR GAS MAKING

PURE DISTILLATE.

HOMOGENEOUS IN CHARACTER.

NO MIXTURE.

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SPECIALLY prepared for Enriching Gas and PREVENTING THE STOPPAGE OF SERVICE-PIPES by the deposit of Naphthalene. Price 10d. per Gallon, free on rails at our Works in Drums (returnable).

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ALFRETON IRON-WORKS, DERBYSHIRE,
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Manufacture and keep in Stock at their Works (also large stock in London)
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NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with Bolts, Nuts and Covers, and rendering Leakage impossible.

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TYNE BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft
Illuminating Power	38·22 candles
Coke per ton	1,301·88 lbs.

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Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	17·8 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

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Best Gas Coal and Cannel, giving High Illuminating Power, Large Yield per ton, and reasonable in Price.
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WITHOUT THE USE OF MANTLES.

Billing's "Non-Mantle" Burner, 5s. 6d. complete. Postage 6d. extra. Pure white, constant brilliant Light. No Trouble, no Renewals. Great Saving in Gas. Fixed easily to any Fittings. Illustrated Catalogue post free. Agents wanted.

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INCANDESCENT GAS LIGHTING.

Incandescent Burners from 5/6 per doz.
Specially annealed best Fireproof Glass Chimneys (equal to the Jena). 1/4 per Doz.
All other Incandescent Fittings at greatly reduced Prices.
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Best "Comet" Bulbs, 2/6 per Dozen. **Write for Illustrated Price Lists.**

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TUBES AND FITTINGS
ALL KINDS
WRITE FOR PRICES
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Rich in Illuminating Power and Yield of Gas. Above the Average in Weight and Quality of Coke.
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MANUFACTURERS OF
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STEEL OF ALL DESCRIPTIONS,
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Painting Speed—3 Square Yards a Minute. Lime-Wash Speed—12 Square Yards a Minute.

Paint Machine, attached to a Single Air-Compressor, Driven by Belt Power. Can also be driven from existing Air-Mains.

No. 1	Painter	£25	Single Air Compressor	£17	10
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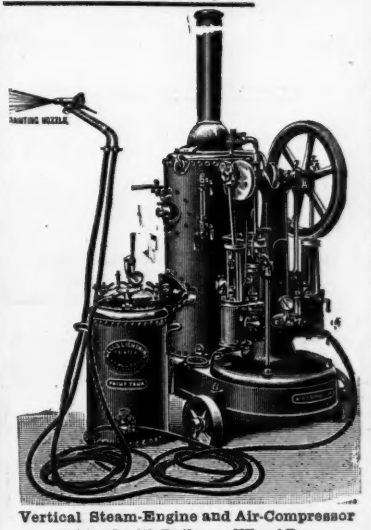
THE GASLIGHT AND COKE COMPANY, THE SOUTH METROPOLITAN GAS COMPANY, THE GLASGOW, BIRMINGHAM, PRESTON, BURSLEM, WARRINGTON, LIVERPOOL, NOTTINGHAM, OLDHAM, STOCKPORT, AND WEST BROMWICH CORPORATION GAS-WORKS, &c.



Vertical Steam-Engine and Air-Compressor combined with Boiler on Wheel Base.

Price £100.
Larger size Engine, &c., adapted for working up to 4 Machines . . . £180.
Painting Machines Extra.

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The Inlet Pressure having absolutely no effect on the open-ended cylindrical Valve, the pressure is maintained constant at the outlet **UNDER ANY CHANGE OF PRESSURE OR DRAUGHT**, and dispenses with the usual complicated balancing arrangements.

Provided with a most **SIMPLE** and **CONVENIENT METHOD** of **WATER LOADING** and **WITHDRAWAL** without syphons or other complications, or with weights to adjust pressure as desired.

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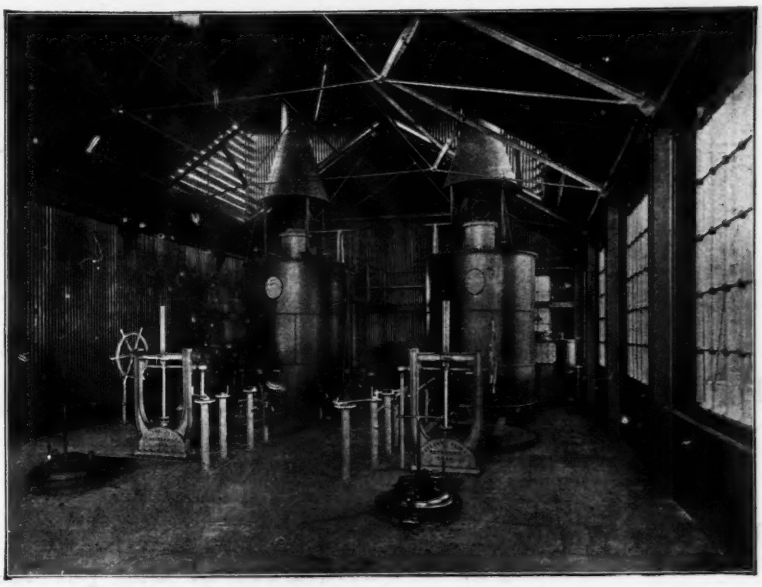
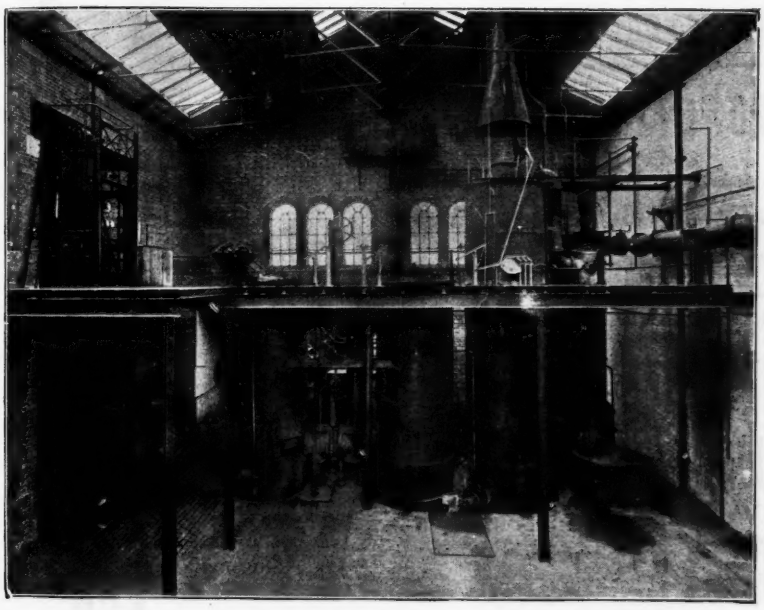


Water-Gas Plant at Southall.



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BUENOS AYRES.
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ADOPTED FOR
MANY IMPORTANT
GASHOLDERS.

OIL-TANKS.

EVERY DESCRIPTION OF GAS-WORKS APPARATUS.

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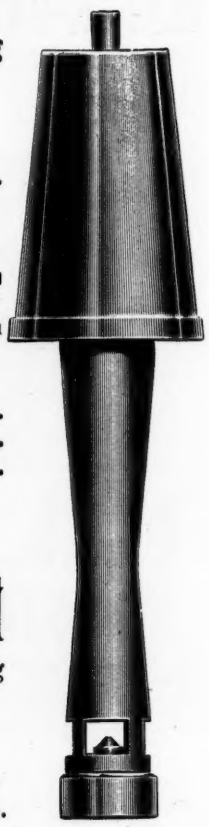
WELSBACH INCANDESCENT GAS-LIGHT.

NEW WELSBACH BURNERS.

25 Candles per Cubic Foot of Gas.

For STREET LIGHTING there is nothing to excel the New Welsbach Burner as shown at Niagara Hall, London, and in the principal Provincial Towns.

The New Welsbach Burner is supplied in SIX Sizes, consuming from ¾ to 7 Cubic Feet of Gas per Hour.



For Street Lighting, the sizes recommended are Nos. 2, 3, & 4.

100 CANDLE POWER WITH 4 CUBIC FEET OF GAS.

To obtain a light of 100 Candles for 4000 hours with Gas at 2s. 3d. per 1000 Cubic Feet would cost—

With an Ordinary Gas-Burner	£18 0s.
With a new Welsbach Burner	£1 16s.
With an Incandescent Electric Lamp, at 5d. per unit	£30 0s.

THE

New Welsbach Anti-Vibration Attachment

Enables the New Welsbach Burner to be used for Street Lighting or otherwise, notwithstanding the severest vibration.

Made of Metal throughout.

Simple, Durable, Inexpensive.

Does not obstruct the Light.

HYDRO-PRESS GAS-LIGHT APPARATUS.

THE NEW METHOD OF PRODUCING A HIGH CANDLE-POWER LIGHT.

Especially recommended for use in Workshops, Railway Yards, and Open Spaces, where a high-power light from one centre is desired.

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LONDON, S.W.

Some of the Gas-Works and Local Authorities using Crosbie's Manufactures.

Aberdovey, Abergavenny, Airedale, Aldridge, Alfreton, Antrim, Armagh, Ascot, Audley, Aylsham, Ballymena, Ballyshannon, Beaumaris, Bentham, Bewdley, Biddulph, Bideford, Birmingham, Blackburn, Blackwell, Bognor, Bollington, Boreham, Bournemouth, Bradley Green, Bramham, Brandon, Bridgnorth, Broadgreen, Broadstairs, Bromsgrove, Broughty Ferry, Builth, Burton, Buxton, Calne, Cannock, Cape Town, Carlow, Castleford, Chester-le-Street, Chesterton, Chipping Wycombe, Cleveland, Clitheroe, Cobham, Coleshill, Collingham, Colney Hatch, Colombo, Coventry, Cranbrook, Cullen, Deddington, Dewsbury, Dover, Downpatrick, Droitwich, Durban, Dursley, East Ardsley, Eastbourne, Elland, Ellesmere, Ellstree, Ennis, Eye, Farnham, Felixstowe, Flint, Garn, Garston, Garw, Gillingham, Gorey, Halesowen, Hanley, Hendon, Hereford, Hinckley, Holywood, Honiton, Hoylake, Huddersfield, Huelva, Huntingdon, Hythe, Ilkeston, Irthlingboro'

PAINTS FOR GAS-WORKS. PAINTS FOR GASHOLDERS.

Contractors to Her Majesty's Government, the Indian Government, the Natal Government, the Turkish Government, the Netherlands Railway, the London County Council, &c., &c.

CROSBIE'S PAINTS.

Guaranteed genuine and free from adulteration, and specially made to withstand Gaseous Fumes.

Catalogue and Testimonials on Application.

ADOLPHE CROSBIE, LTD.,

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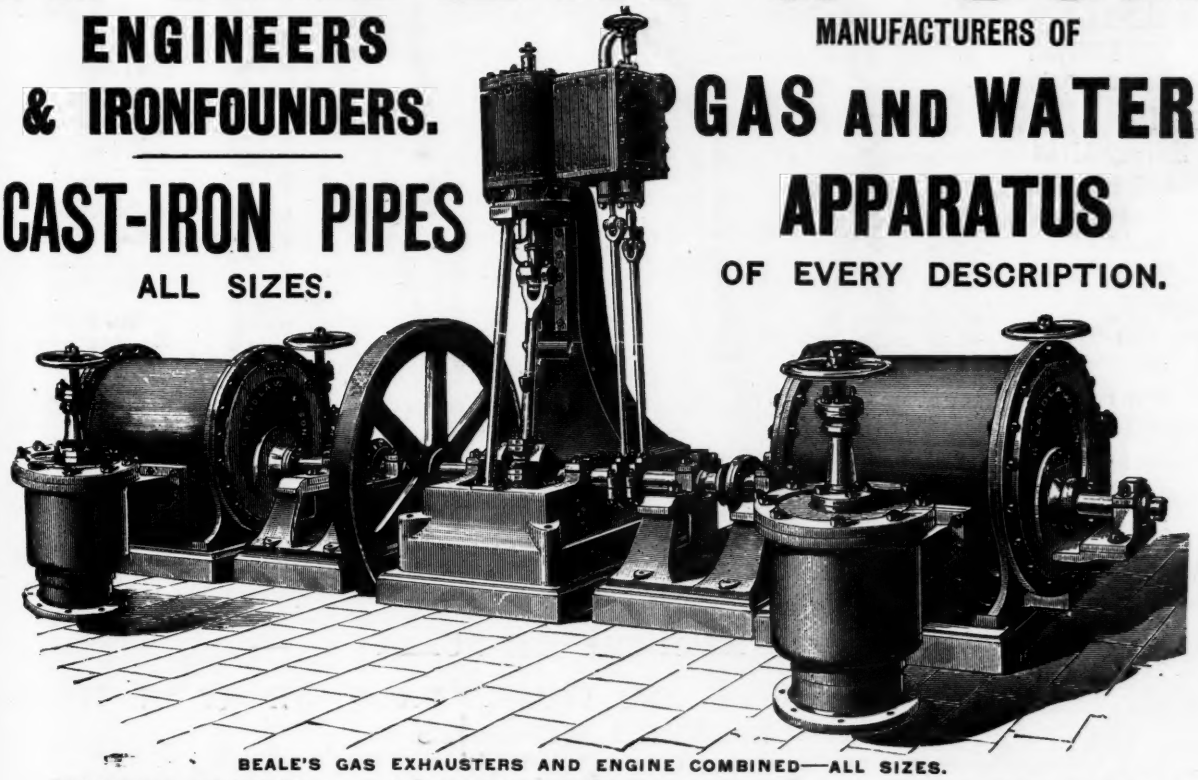
R. LAIDLAW & SON

ENGINEERS & IRONFOUNDERS.

MANUFACTURERS OF GAS AND WATER APPARATUS OF EVERY DESCRIPTION.

CAST-IRON PIPES ALL SIZES.



BEALE'S GAS EXHAUSTERS AND ENGINE COMBINED—ALL SIZES.

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ARROL-FOULIS

PATENT HYDRAULIC MACHINERY

FOR

CHARGING AND DRAWING GAS-RETORTS

SIR WILLIAM ARROL & CO., Ltd., Sole Makers,
DALMARNOCK IRON-WORKS, BRIDGETON,
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ARROL-FOULIS
MACHINES
Are Employed at the following Works—

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GASLIGHT & COKE COMPANY—
Beckton.

SOUTH METROPOLITAN GAS COMPANY—
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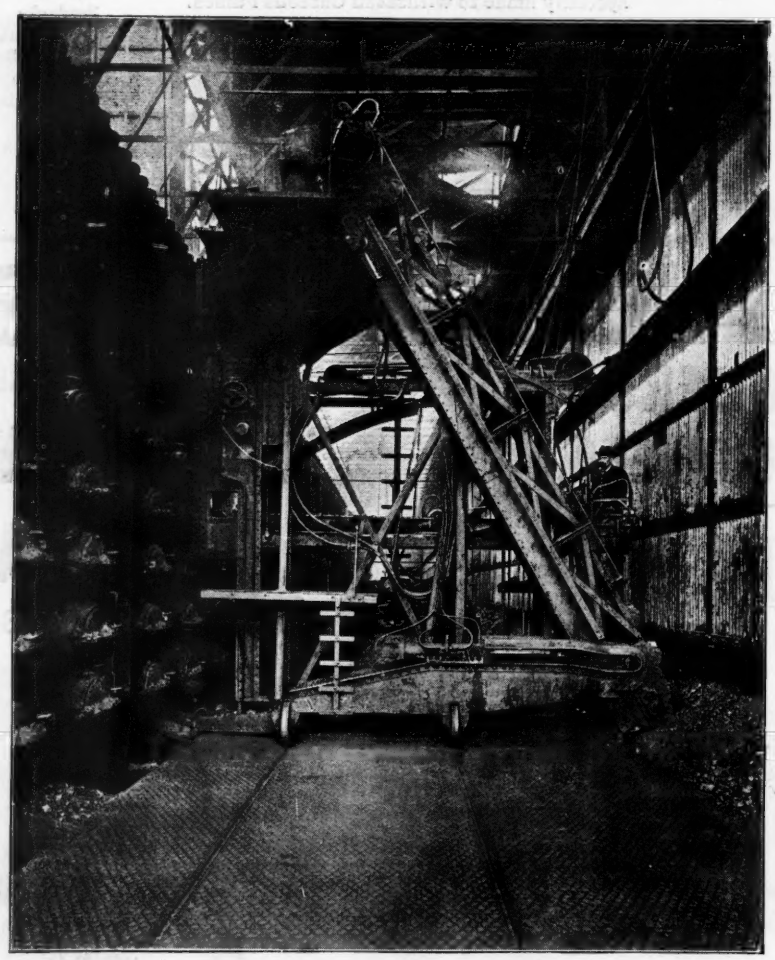
Vauxhall.
Rotherhithe.

COMMERCIAL GAS-WORKS—
Wapping.
Poplar.

BROMLEY GAS-WORKS (KENT).

EDINBURGH GAS-WORKS.

LIVERPOOL GAS-WORKS.



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ARROL-FOULIS
MACHINES
Are Employed at the following Works—

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CLEVELAND GAS-WORKS—
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&c., &c., &c.

OVER 200 MACHINES ARE AT WORK OR IN COURSE OF CONSTRUCTION.

ROTHERHITHE GAS-WORKS.

THE TIME TAKEN TO DRAW AND CHARGE EACH RETORT BY THESE MACHINES AVERAGES

ONE MINUTE.

THOMAS PIGGOTT & CO., LTD., BIRMINGHAM.

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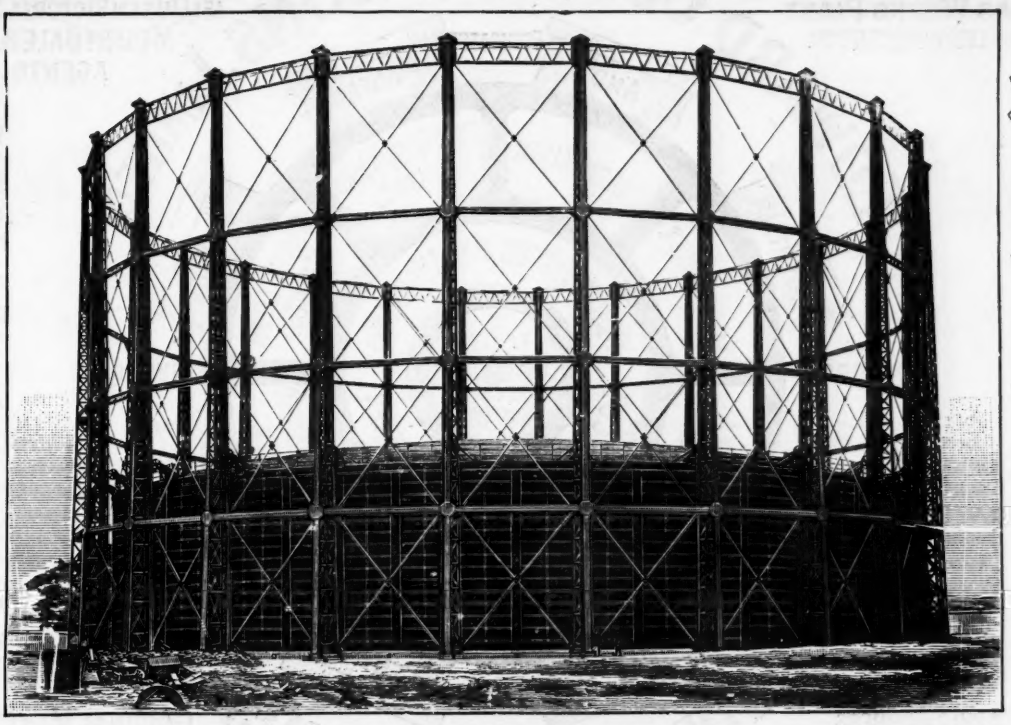
GAS PLANTS, BOILERS, ENGINES, PUMPS, ROOFS, RETORT FITTINGS, ETC.



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MANUFACTURERS OF

Humphreys & Glasgow's Patent Carburetted Water-Gas Plant.

INSTALLATIONS HAVE ALREADY BEEN SUPPLIED, AND ARE IN HAND FOR THE FOLLOWING GAS-WORKS: COPENHAGEN, BELFAST, GLASGOW, BRUSSELS, SANTIAGO, SWANSEA, TOTTENHAM, LIVERPOOL, BATH, PRESTON, SOUTHPORT, HOYLAKE, BELFAST (SECOND CONTRACT), EDINBURGH, TOTTENHAM (SECOND CONTRACT), WINCHESTER, MANCHESTER, BRUSSELS (SECOND CONTRACT), SHANGHAI, STOCKTON, STOCKPORT, NORWICH, GUILDFORD, LEA BRIDGE, COVENTRY, COMMERCIAL, BRENTFORD, BRIDLINGTON, MIDDLESBROUGH, CROYDON, L. & N. W. RAILWAY CREWE, NINE ELMS, BROMLEY, COVENTRY (SECOND CONTRACT), TAUNTON, ROTTERDAM, DORKING, LEA BRIDGE (SECOND CONTRACT), LIVERPOOL (SECOND CONTRACT), SCARBOROUGH, DURHAM, PERTH (WESTERN AUSTRALIA), COMMERCIAL (SECOND CONTRACT), COMMERCIAL (THIRD CONTRACT), MAIDENHEAD, EPSOM, NORTH MIDDLESEX, BREMEN, WANDSWORTH, FALMOUTH, AARHUS, SOUTHAMPTON, COPENHAGEN (SECOND CONTRACT), WEST HARTLEPOOL, STOCKPORT (SECOND CONTRACT), BOURNEMOUTH, PORTSMOUTH, AYLESBURY, BECKTON (RECONSTRUCTION), & DUBLIN.

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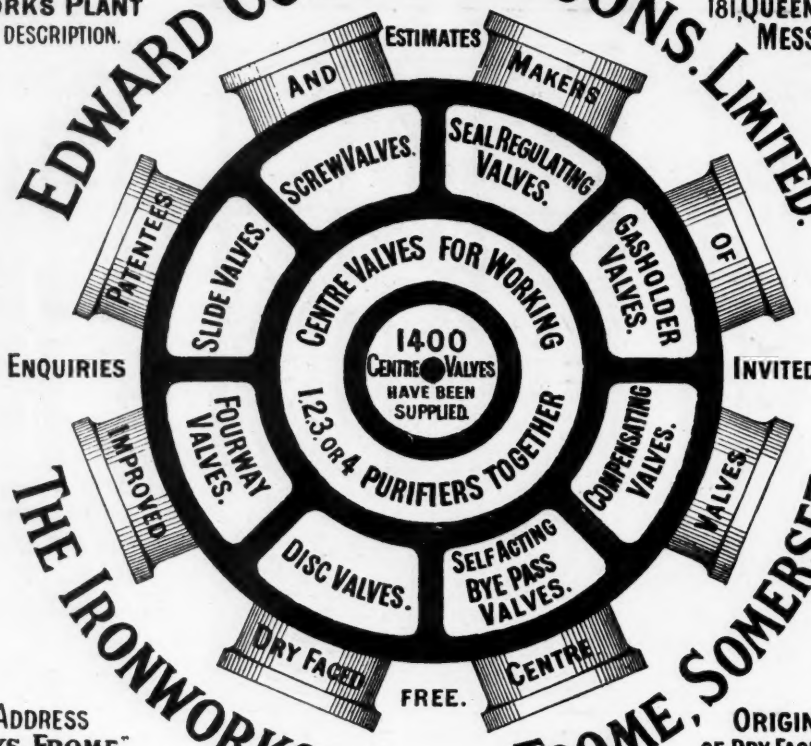
PATENT COMBINED BYE-PASS & COMPENSATOR FOR EXHAUSTERS.



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THE IRONWORKS FROME, SOMERSET.

TELEGRAPHIC ADDRESS "COCKEYS FROME" "DAMPER LONDON"

ORIGINAL MAKERS OF DRY-FACED CENTRE VALVES. ESTABLISHED OVER HALF A CENTURY.

PATENT FIRE DOORS & FRAMES.

THE

MAXIM PATENT CARBURETTOR

FOR ENRICHING GAS IN BULK.

OVER 60 MAXIM PATENT CARBURETTORS HAVE NOW BEEN FIXED.

Among the Companies supplied are The Gas Light and Coke Company, The South Metropolitan Gas Company, Birmingham Corporation, Manchester Corporation, Rochdale Corporation, Bristol Gas Company, and many other Works, both large and small, where they have been working in some instances for the past **Seven Years.**

MORE GAS & SALEABLE COKE PER TON of COAL CARBONIZED is PRODUCED; SAVING CAPITAL, LABOUR, FUEL, WEAR & TEAR, &c.

THE ENRICHMENT IS INSTANTANEOUS AND PERMANENT.

The Carburettor is inexpensive, easily fixed, and entirely supersedes the use of Cannel.

SOLE AGENTS FOR REDWOOD & CLOWES' INFLAMMABLE VAPOUR & GAS DETECTORS.

Dealers in Carburine and all other Naphthas and Oils suitable for the Enrichment of Gas.

For Prices and full Particulars, apply to

THE GAS LIGHTING IMPROVEMENT COMPANY, LIMITED,

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Telephone No. 103. Telegraphic Address: "ELEVATOR, HASLINGDEN."

S. S. STOTT & CO.,

ENGINEERS HASLINGDEN, NR. MANCHESTER.

COAL AND COKE ELEVATORS & CONVEYORS.

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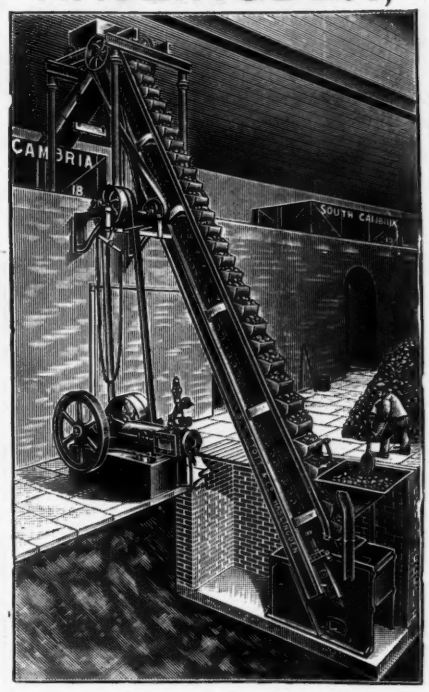
DETACHABLE CHAINS AND SPROCKET WHEELS.



LIME AND OXIDE ELEVATORS & CONVEYORS.

HIGH-CLASS STEAM-ENGINES up to 1000-Horse Power.

PUMPS, HORIZONTAL AND VERTICAL, SINGLE, DOUBLE, or THREE-THROW, for WATER-WORKS, &c.

BEAM PUMPING-ENGINES.

AIR-COMPRESSORS.

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Coke Elevator Loading Railway Waggons.

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MANUFACTURERS OF

WET AND DRY GAS-METERS, STATION METERS, GOVERNORS, GAS APPARATUS, ETC.

SQUARE STATION METERS WITH PLANED JOINTS.

STATION METERS IN CYLINDRICAL CASES.

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STATION METERS MADE AT THE COMPANY'S WORKS, OLDHAM (Late WEST & GREGSON). Established 1815.

Prices and Particulars apply to

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[See Advertisement on back of Wrapper.

MY

"DECISION" PORTABLE REGISTER

AND

PRESSURE & EXHAUST REGISTER

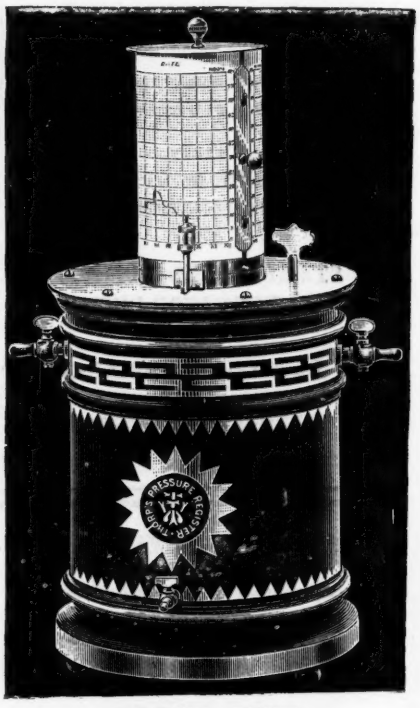
PRICE £7.

MAKE THE BEST DIAGRAMS.

DO NOT GET OUT OF ORDER.

WILL LAST A LIFETIME.

The Diagrams are in Ink, and are perfectly reliable.



Invaluable for obtaining reliable Diagrams of Pressures.

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6-inch Range	.	£8 10 6
8-inch do.	.	£9 10 6
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Improved Street Lighting.

A Catalogue is in course of preparation showing the latest and most improved System of Outdoor Lighting, and will be sent to any address on application being made to

THOS. G. MARSH,

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HUTCHINSON BROTHERS & CO., LTD.,

Gas Engineers, &c.,

MAKERS OF

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BRASS MAIN AND LAMP TAPS,
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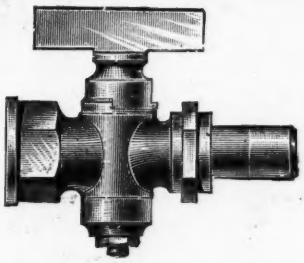
SERVICE CLEANERS,
SYPHON AND OTHER PUMPS.

LEAD WORK FOR SULPHATE OF AMMONIA PLANTS.

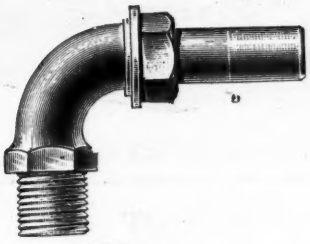
CHEMICAL LEAD-BURNING APPARATUS, COPPER SCOOPS,
PURIFIER GRIDS, TOOLS, & SUNDRIES FOR GAS-WORKS.

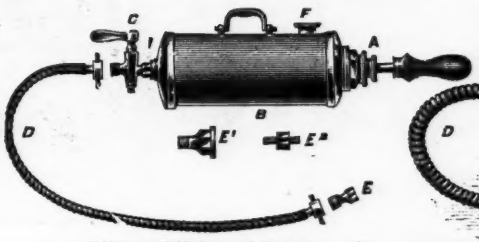
"FALCON" LAMP TORCH.

BRASS FERRULES.


MAIN TAP.

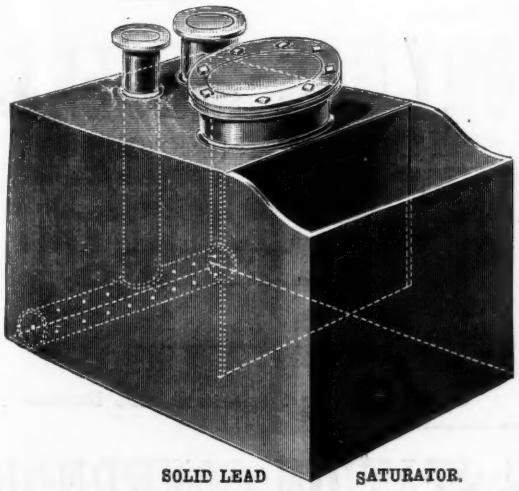
LAMP TAP.





LAMP SERVICE-CLEANER.

SERVICE CLEANER


SOLID LEAD SATURATOR.

LISTS
and
PRICES
on
APPLICATION.

SYPHON PUMPS.

FALCON WORKS, SACKVILLE STREET, BARNSLEY.

Telegraphic Address: "HUTCHINSON BROS., BARNSLEY."

J. & J. BRADDOCK

(BRANCH OF METERS LIMITED),

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Telegrams: "BRADDOCK, OLDHAM." National Telephone No. 254.

AND 45 & 47, WESTMINSTER BRIDGE ROAD, LONDON, S.E.

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MANUFACTURERS OF

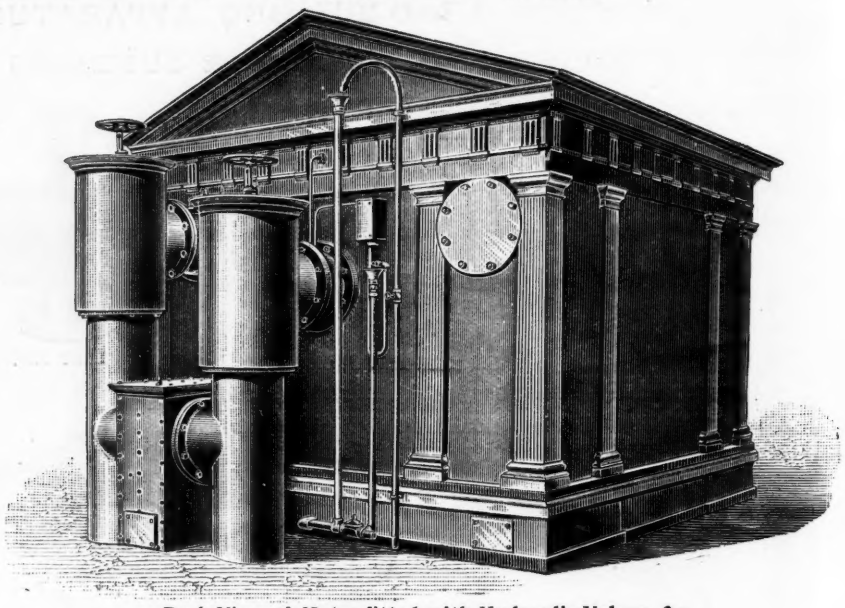
IMPROVED GAS STATION METERS

(OF ALL CAPACITIES UP TO 300,000 CUBIC FEET PER HOUR),

IN CYLINDRICAL AND RECTANGULAR CASES.

OF THE BEST QUALITY AND CONSTRUCTION.

PRICES AND PARTICULARS OF ANY SIZE UPON APPLICATION.



Back View of Meter fitted with Hydraulic Valves, &c.

BRADDOCK'S PATENT PENNY-IN-THE-SLOT

(ALSO SHILLING-IN-THE-SLOT)

PREPAYMENT WET AND DRY GAS-METERS.

STRONG AND RELIABLE. DURABLE AND SATISFACTORY.

NO DELICATE PARTS.

IMPROVED DRY GAS-METERS,

WITH "SEAMLESS" DIAPHRAGMS, IN THE

BEST CHARCOAL ANNEALED TIN-PLATE CASES

OF SUPERIOR DESIGN AND STRENGTH.

Thoroughly well made. Accurate and Reliable. Unequalled for Soundness and Durability.

BRADDOCK'S New Patent GAS STATION GOVERNOR

Which gives a Steady Outlet Pressure under all conditions.

Very Extensively Adopted. *Repeat Orders Received from London and Provincial Companies.*

W. C. HOLMES & CO.

PATENT 'NEW' SCRUBBER-WASHER

In HORIZONTAL or VERTICAL FORM, where economy in FLOOR AREA is required.

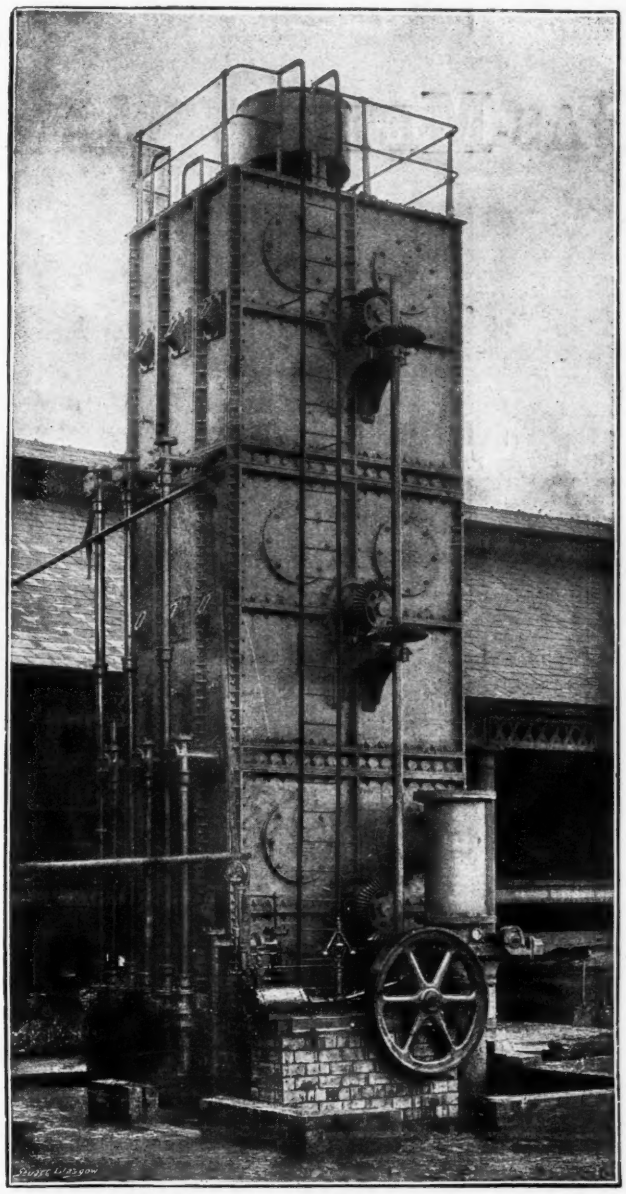
Removes every trace of Tar that may escape Condensation in the Condensers.

Complete Extraction of Ammonia from the Gas without affecting the Hydrocarbons.

Maximum Strength of Liquor obtained.

Minimum Quantity of fresh Water required.

Removal to a large extent of the Sulphuretted Hydrogen and Carbonic Acid Gas.



A Machine constructed for 1,500,000 cubic feet of Gas per diem dealt efficiently with 1,800,000 cubic feet of Gas, giving only 1-inch back pressure, or 1500 cubic feet per diem per cubic foot gross area.

NOTE.—Since Improvements patented in 1895-1897, **61** MACHINES, equal to a daily capacity of

62,740,000 CUBIC FEET,

Have been erected, or are at present on order.

WORKS:

Turnbridge Foundry, and Whitestone Iron-Works,

HUDDERSFIELD.

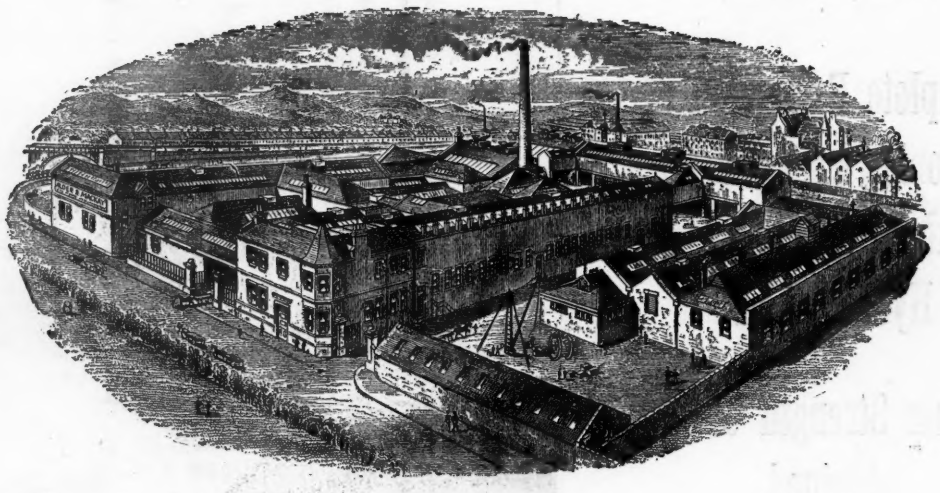
Telegrams: "HOLMES, HUDDERSFIELD."

London Office: 80, CANNON ST., E.C. *Telegrams:* "IGNITOR."

ALDER & MACKAY

ESTABLISHED 1850.

GAS-METER MANUFACTURERS.



SPECIALITIES.

Dry Meters in Cast-Iron Cases.

Wet and Dry Prepayment Meters.

Green's Patent Underground Wet Meters.

NEW GRANGE WORKS, Telephone No. 81 Western. EDINBURGH.

Telegrams: "ALDER" EDINBURGH OR BRADFORD.

VENTNOR STREET WORKS, Telephone No. 1222. BRADFORD.

THE DAVIS GAS-STOVE COMPANY'S (LIMITED)

Up-to-Date Slot Cookers

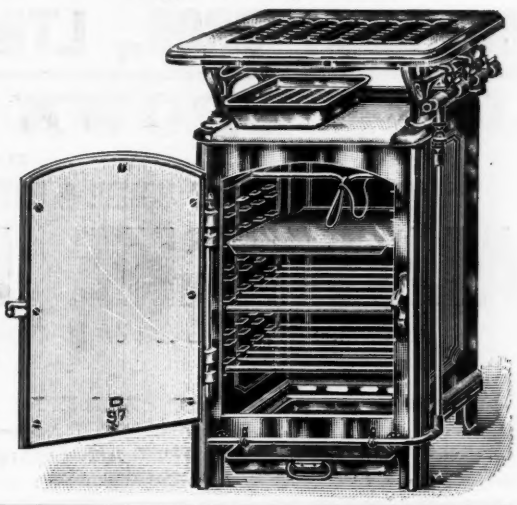
D. 97. Showing Removable Burners.

DESCRIPTION.

FOR a Cheap yet Serviceable Up-to-Date Slot Cooker, we can with confidence commend to the notice of Managers of Gas Companies and Corporations our D. 97. It is fitted with Loose Burners, consisting of one Grilling, one round Boiling, and one Simmering Burner, all of which may be of cast or wrought iron as desired. Our Patent Steel Wire Heat-Deflector can be used with either cast or wrought Burners.

The Loose Burners are held in position by our Patent Locking Bar. If required, the crown of the oven can be covered with a removable loose, sliding, enamelled Top-Plate, which could be replaced at a trifling cost. The top of the inside of the Oven can be double-cased and packed, and the door have an enamelled door-plate, forming a chamber filled with non-conducting material if desired.

D. 97. With Open Door.



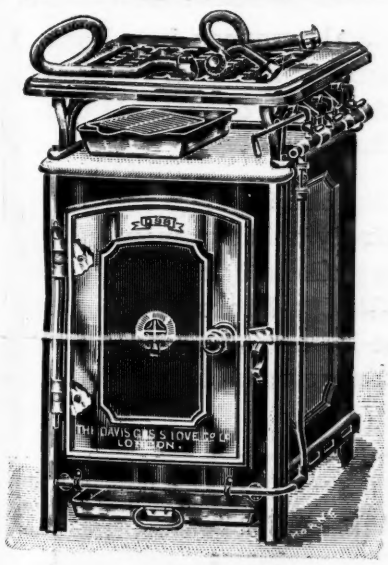
FITTINGS.

2 Oven Grid Shelves,
1 Sheet-Iron Shelf,
1 Tinned Iron Drip Pan,
1 Tinned Cross Bar
1 Meat-Hook,
Deflector, Pan, and Grid.

DIMENSIONS.

	High.	Wide.	Deep.
Height over all			32in.
Oven (inside measurements) ...	24in.	by 13in.	by 11½in.
Door Opening		20½in.	„ 13in.
Hot-Plate		19in.	„ 15in.
Between Hot-Plate and Top-Plate			6in.

D. 98. Showing Removable Burners.



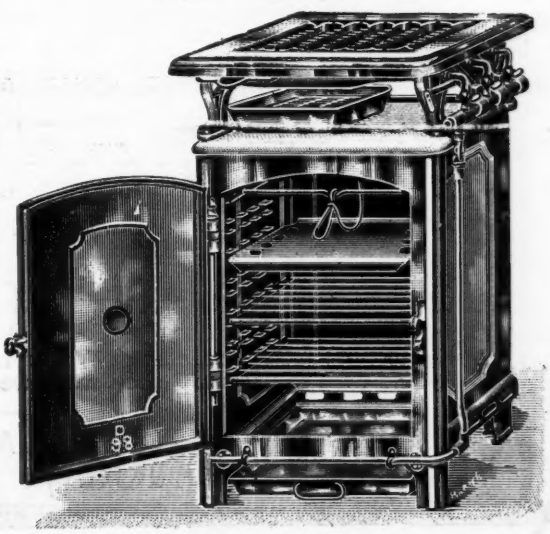
DESCRIPTION.

THE D. 98 is the Slot Cooker adopted by some of the London Gas Companies who have already had a great number fixed, with satisfaction to their consumers. It is fitted with two loose wrought Burners and one cast Simmering Burner, with wrought shank.

As usually supplied, it has a plain black Top-Plate, plain Door, a double-cased and packed top, steel Heat-Deflector, and 99a Pan and Grid.

Any of the usual extras can be added to this Stove if required.

D. 98. With Open Door.



FITTINGS.

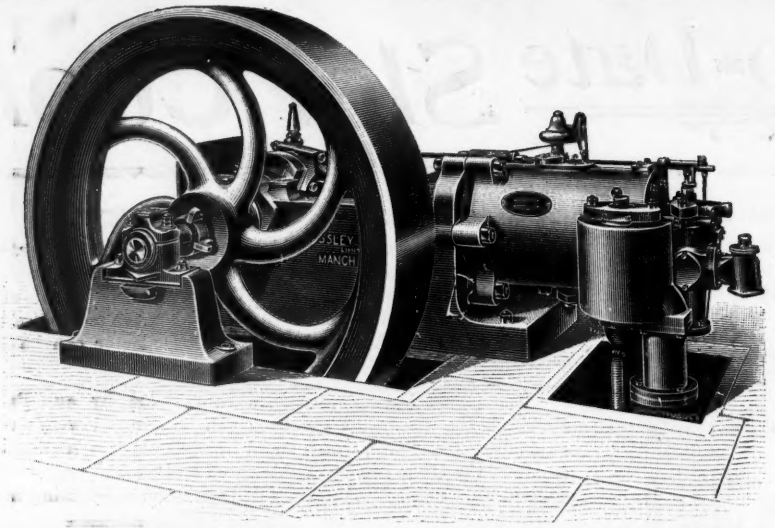
2 Oven Grid Shelves,
1 Sheet-Iron Shelf,
1 Tinned Iron Drip Pan,
1 Tinned Cross Bar,
1 Meat-Hook,
Deflector, Grill Pan, and Grid.

DIMENSIONS.

	High.	Wide.	Deep.
Height over all			32in.
Oven (inside measurements ...	24in.	by 14in.	by 12in.
Hot-Plate		20in.	„ 16in.

Metropolitan Engineering Works, CAMBERWELL, S.E.

CROSSLEY'S GAS-ENGINES



Represents 16-horse power and 20-horse power nominal High-Speed Electric Light Engines.

CROSSLEY BROS., LTD., OPENSHAW, MANCHESTER.

JOHN BROWN & CO., LTD., SHEFFIELD,

Proprietors of

ALDWARKE MAIN, CAR HOUSE & ROTHERHAM MAIN COLLIERIES, NEAR ROTHERHAM.

ALDWARKE MAIN GAS COAL

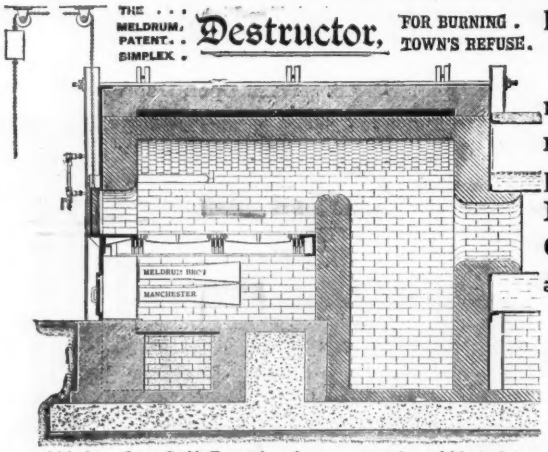
Analysis: 12,600 Feet of 19-Candle Gas per Ton.

Value in Pounds of Sperm, 820·80.

VERY FREE FROM IMPURITIES.

TELEGRAMS: "ATLAS, SHEFFIELD."

THE Utilization of Towns' Refuse for some practical purpose has been successfully solved; and there is, therefore, no reason why every township should not have its own Electric Light Installation, and obtain all the power from its Dust-Bins.



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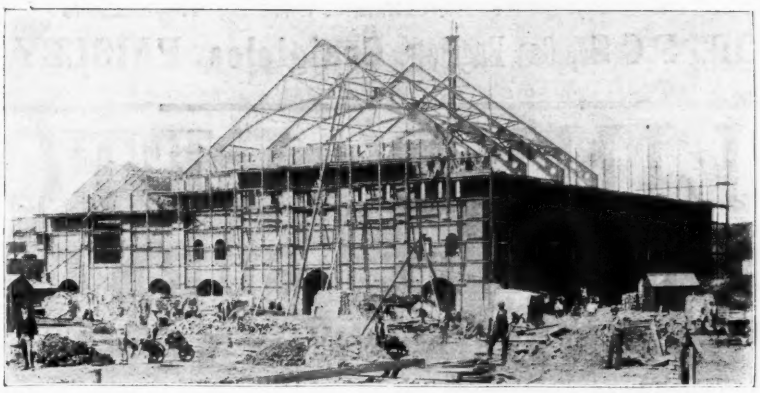

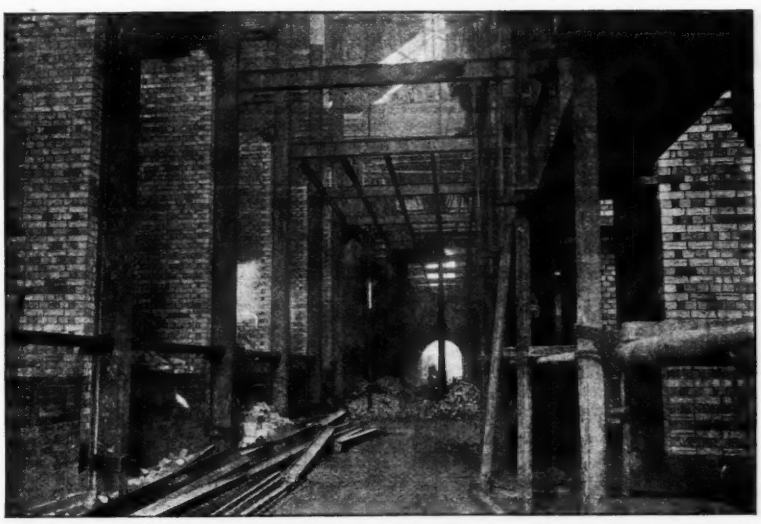

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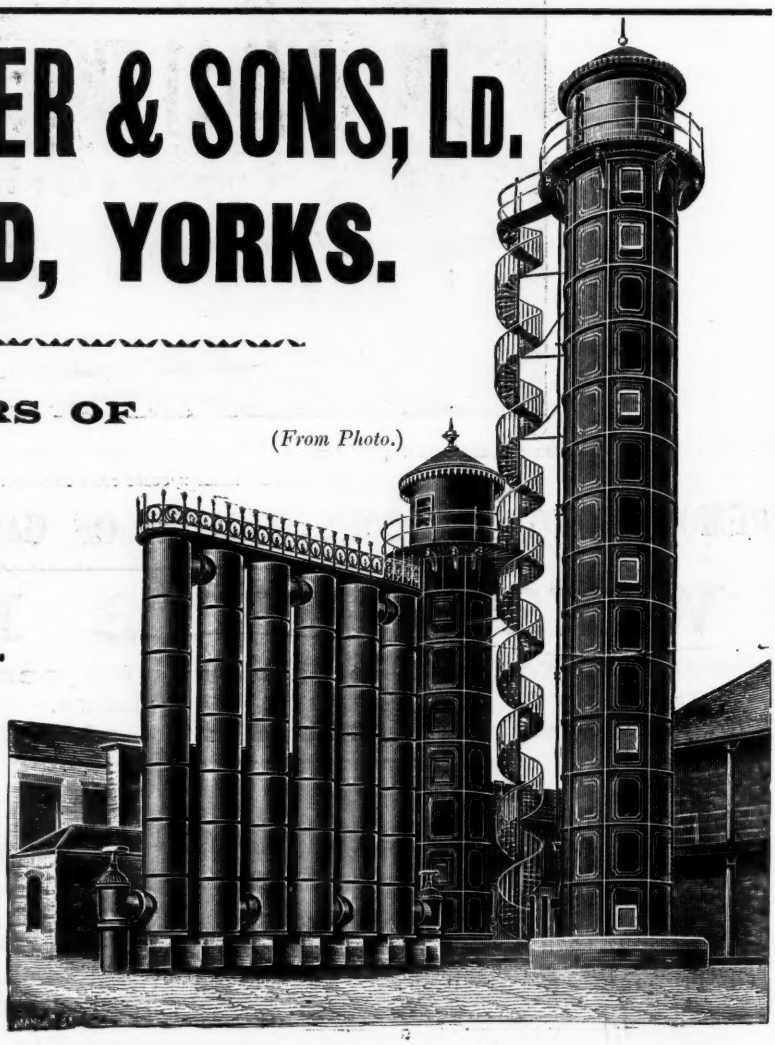

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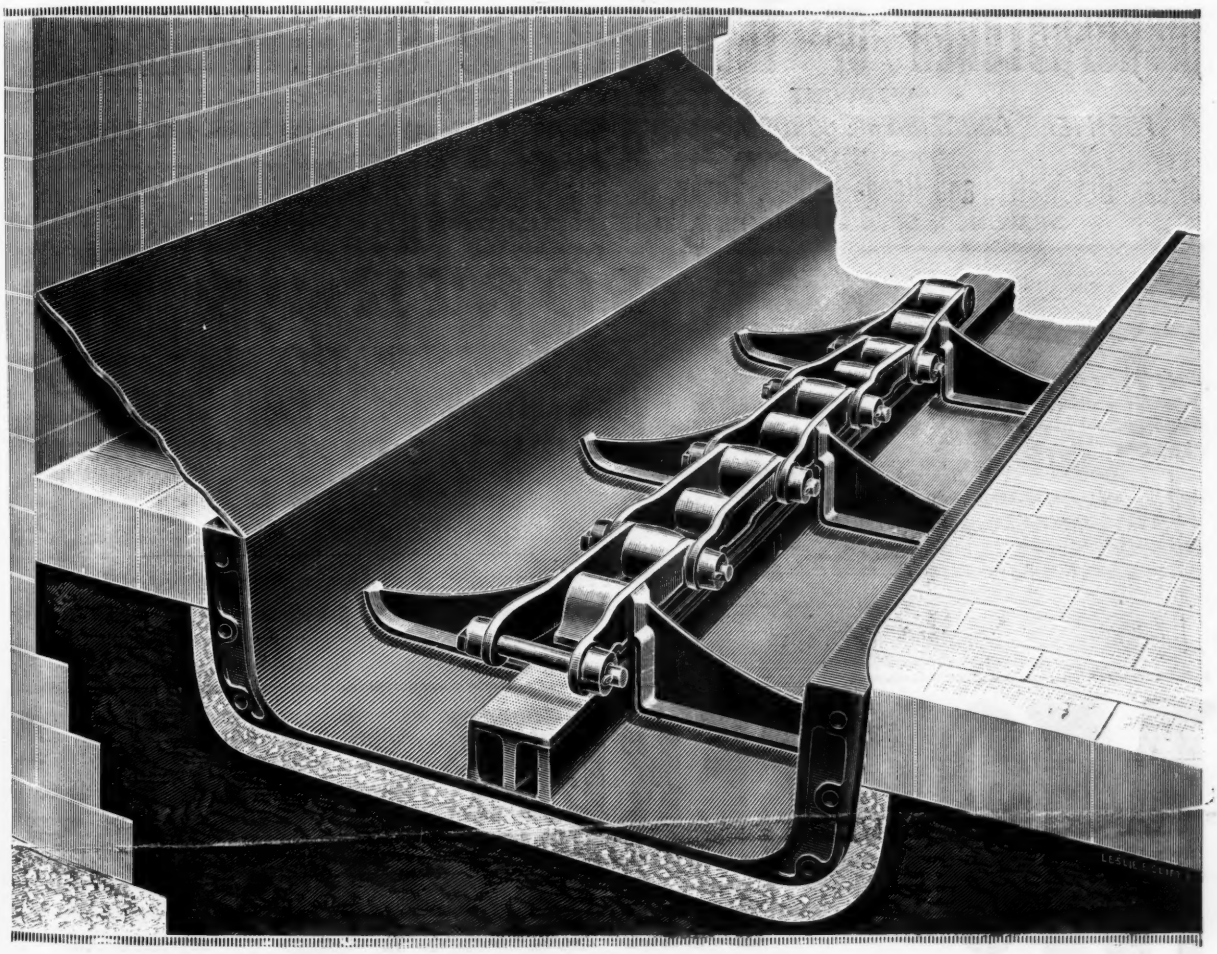

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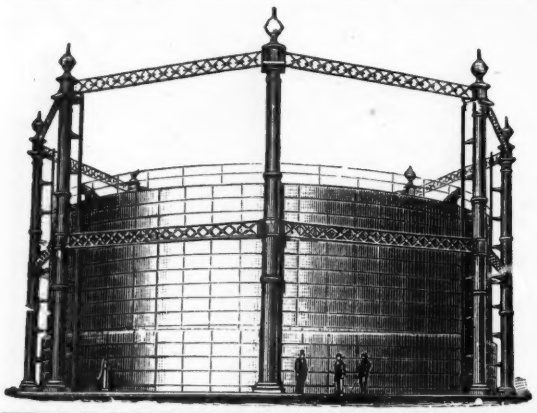

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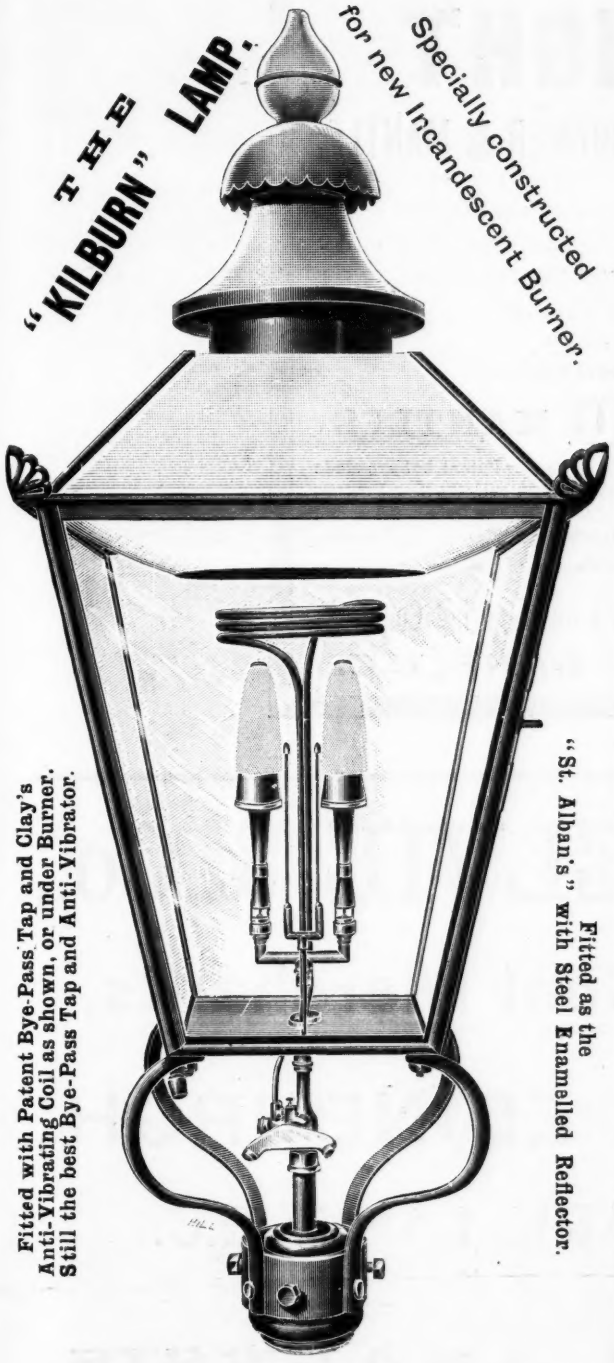

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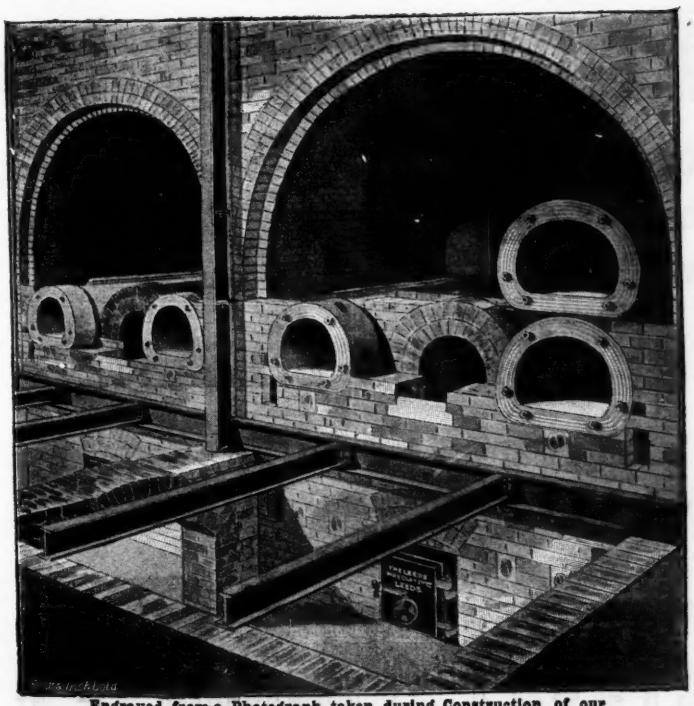

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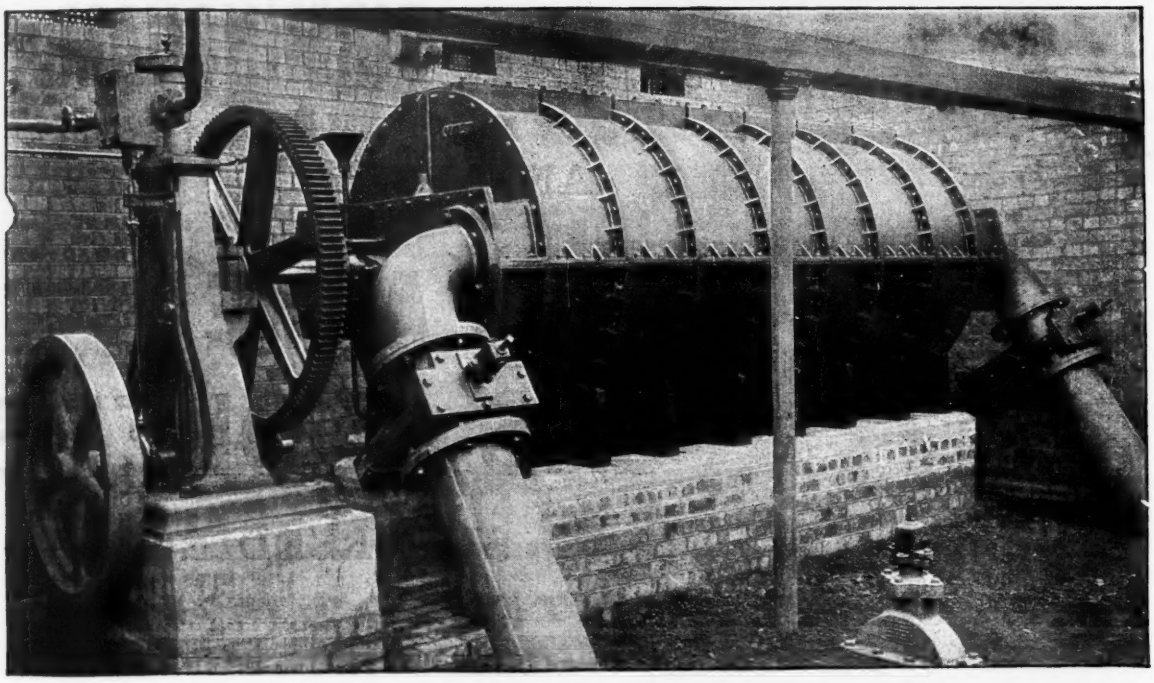

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Liverpool (Second Contract)	4,500,000	Lawrence, Mass.	400,000
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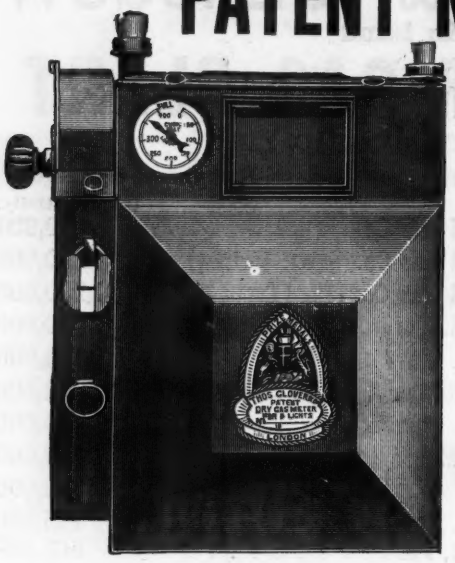

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[See Advt. p. VII., centre of "JOURNAL."

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EDITORIAL NOTES.

The Meeting of the Institution of Gas Engineers.

THE meeting of the Institution of Gas Engineers last week was held under the most favourable auspices. No more popular President than Mr. F. D. Marshall could be found in the ranks of the organization; and by his Inaugural Address and his conduct in the chair he amply justified the high expectations that had been formed respecting his behaviour in this capacity. Mr. Marshall, moreover, well maintained, and even advanced, the international sentiment which has attached itself to the conduct of the Institution, and constitutes one of the chief charms of this technical society for those gas engineers who like to know how the world wags outside their own sometimes narrow circle. Mr. Marshall, thorough Englishman as he is, has yet learnt to appreciate the diverse excellencies of those other technicians of the great Teutonic stock who are not English; and his outspoken admiration of some of these merits is as stimulating as it is honest and well founded. There was no more instructive part of Mr. Marshall's work for the Institution than his strenuous advocacy of a higher standard of technical qualification for the British gas engineering service. He knows at first hand what Germans, for instance, are doing in this line; and he is almost painfully anxious that Englishmen should not remain content with a poorer equipment.

There is only too much reason for Mr. Marshall's fears, if the quality of the papers provided by the efforts of the Council for this meeting is to be taken as an indication of the present condition of the British technic. The programme looked poor; and its realization was even worse than the promise. With the exceptions of Mr. Irminger's contribution and Professor Lewes's donation, the technical fare supplied for the entertainment of the meeting was not above the standard of any District Gas Managers' Association. It is a painful subject; and it can do no good to dwell upon a fact which was only too obvious to those who faithfully sat through the succession of papers. Some of these will be very useful for reference, when printed in the "Transactions;" but one can only pity a Council who had to accept and put them in order for reading. Surely, one may be pardoned for thinking, a society which claims to represent the best of English gas engineers ought to be able to produce something better worth coming to London for than this "chronicle of small beer."

Of course, much of the blame for the deadly dulness of the papers may be referred to the state of the industry at large, which seems to be destitute of really "burning "questions" at this particular juncture. Nobody, perhaps, is to be blamed for this, because no industry can always be redolent of the interest of new movements and great developments. Let us hope that this is what is the matter with the Institution. It is as well, however, for the facts of the case to be recognized, in order that everybody concerned may realize his individual responsibility for a depressing condition of things. Last week's meeting was saved from being an utter *fiasco* by the President's address at the start and the excursion at the finish. These were almost accidents, however; and a wet day would certainly have extinguished the recuperative powers of the latter fixture. A strong effort—of which more hereafter—is to be made to impart exceptional interest and value to the Autumn meeting. The Council will have to see to it, after this, that next year does not repeat the inanity of this last deplorable performance. We do not desire to say unkind things of anybody—still less of the contributors of this year's papers, who doubtless worked hard and did their best. The nature of the material was wrong; and consequently the general result was unfortunate to a degree.

Sir James Rankin's Committee.

THE proceedings of Sir James Rankin's Committee last Thursday comprised the taking of evidence by Mr. Charles Hunt, who appeared for the London County Council, and by Mr. Joseph Trenner, representing the dissatisfied Local Authorities on the north side of the Thames. The latter witness expressed in the most concise form the object which the public for whom he appeared sought to attain by this inquiry. He told the Committee he was instructed to urge the desirability of a uniform gas charge for the whole of London; but he had no suggestion to offer as to how this could be brought about. This is the *crux* of the whole question. Mr. Hunt, speaking as a gas expert, had

chiefly to support the masterly statement prepared by Mr. Haward. His criticism of the working of The Gaslight and Coke Company was on familiar lines. The only suggestion he had to offer by way of dealing with the existing trouble is to transfer to the South Metropolitan Company the portion of the old London Company's district south of the Thames. He made out that the existing arrangements put an extra charge of 1d. per 1000 cubic feet on the price to private consumers on the north side. The other causes adduced as contributing to the high price of Chartered gas north of the Thames are: (1) An undue expenditure on capital account; (2) a reduction in the rate of increase of the ordinary consumption; and (3) an increased cost of coal and working expenses. Mr. Hunt put the waste of capital by the Horseferry Road administration at about a million-and-a-half sterling for the past ten years. He as good as said that the Company have nothing to show for this extra expenditure, inasmuch as they are now asking for more money to spend upon labour-saving plant and other things which should have been anticipated out of this outlay. The general purport of Mr. Hunt's proof, which we reproduce practically in full, is to support in detail Mr. Haward's impeachment of The Gaslight and Coke Company's administration. There cannot remain much more to be said on this score; and it is understood that the case of the London County Council is now complete. How much longer the inquiry will last cannot be foreseen; but if it is correctly rumoured that the Committee have had the further progress of the Company's Money Bill arrested till they can decide upon what should be done in the matter, the outlook is sufficiently grave.

Imperial Continental Affairs.

THE Half-Yearly Ordinary General Meeting of the Imperial Continental Gas Association was held on Tuesday, under the presidency of the Chairman (Mr. T. H. Goodwin Newton). The report of the Directors was of an extremely satisfactory character. The quantity of gas made at the works of the Association exhibits a decrease of only 5·6 per cent. as compared with the output for the corresponding half of 1897, notwithstanding the loss in the interim of the supply of Amsterdam. This means that, thanks to the growth of the demand for gas from the other stations, the loss of Amsterdam has been recovered to the extent of 44 per cent. in the short period of six months. This important transfer, it is recorded, was effected on Aug. 10 last, in the smoothest possible manner. There are still 32 towns directly lighted by the Association. The gas affairs of Vienna are dismissed in the report in a short paragraph, the brevity of which does not obscure the importance of the triumph signalized. The Chairman added some pregnant words to this gratifying announcement. Of course, the expiry of the Association's lease of Central Vienna must be a serious loss of business; but, by way of recompense, they will have an assured position in the developing suburbs. The vote of £5000 to the Directors, by way of acknowledgment on the part of the proprietors of the special services rendered by the Board in respect of the Amsterdam and Vienna negotiations, has been fairly earned. It is nevertheless honourable to the proprietors that they have acknowledged, in so substantial a way, the quality of the Board's statesmanship. Such a business as that of the Association is not to be preserved and directed to financially successful issues without the employment of the highest order of administrative ability; and there are times, as history records, when difficulties become congested into emergencies calling for heroic methods of deliverance.

A Blunder in Cutting Off.

A VERY simple and ordinary point of Gas Companies' business gave rise to a law case which we report to-day, of *Griffiths and Another v. The Ilford Gaslight and Coke Company*. The plaintiffs, owners of a public-house in the Company's district, recovered £50 damages from the Company for cutting off the supply of gas. It appears that a former occupier of the house was in arrears for his gas, and had received a cutting-off notice. At the same period he was also behindhand with his mortgage interest, and arrangements were in progress for getting him out of the premises. On Oct. 14, the new occupiers—the plaintiffs in this action—sent formal notice to the Company that they should be taking possession on Oct. 17; and on this date the inspector came and took the register of the meter, in order to ascertain how much was due by the outgoing tenant. But this individual went out on Oct. 14; and the new people came in on the following day. Consequently, when the account was presented, the old occupier had disappeared, and the new-comers disclaimed any liability. The Company, not unnaturally, thought that, in the circumstances, they had a claim upon the successors of the old tenant, who must have left by arrangement three days earlier than the date notified. They tried putting pressure upon these parties, and cut off the gas on Oct. 21—renewing the supply three days later. In the event, the Company lost the amount of the old bill, £50 for damages, and the costs, because they had contravened the 39th section of the Gas-Works Clauses Act, 1871, by trying to make the new occupiers pay the arrears of the outgoing tenant. In further defence, they set up the language of section 11, which requires a demand for gas to be in writing. This failed; the Judge holding that, having transgressed under one clause of the Act, they could not fall back upon another. This may be law; but we imagine that most people, upon reading the story, will be of opinion that the Company's case is a hard one, and that somebody must have blundered over it. Our own judgment suggests that the mistake began in the failure to deal more promptly with the old tenant while he still remained in nominal possession. When the Company discovered that the bird had flown—which the inspector must have learnt when he went to take the register of the meter—the actual occupiers should have been faced with the terms of their notice, and an arrangement entered into with reference to the whole affair. Clearly, the Company's officers were to blame in not realizing the nature of the situation. To send four days later and cut off the supply, was certainly the wrong way to go to work to redress the injury the Company had undoubtedly suffered. They had a new consumer to deal with, which was so far a gain. By how much this new consumer had contributed to the loss of the old debt, was a question for the Courts to settle in the regular way. By cutting off the gas when they did, the Company put themselves out of Court; while the quibble over the requirements of section 11 was, in the circumstances, a piece of attorneyism totally inadequate to retrieve the lost position of legality.

Exit the Scottish Niagara.

THE rejection by Sir James Kitson's Committee of the Highland Water Power Bill, is one of those hard facts against which enthusiasm and vague sentiment on the side of "electricity for everything" bring up with a severe shock. The followers of the gas industry in particular have good reason for taking note of this important decision, as it goes dead against the popular idea that the time has come when electrical power, generated and distributed on the Niagara model, can supersede every other source of energy. The fate of the various "pit-head" schemes settled earlier in the session possessed a degree of significance of the same kind; but in these cases the issue was complicated by other considerations connected with the commercial interest of Local Authorities. We argued at the time that, while all these schemes had been got rid of by a side wind, they did not possess sufficient merit of their own to deserve a kinder fate. There was never adequate proof that "pit-head" electricity generation in bulk was, in point of fact, worth doing, or would result in anything more than a big electrical "boom" such as the country should certainly be spared. What was lacking in these cases—a complete threshing out of the proposals of the promoters on the merits—has been supplied in the proceedings on the Highland Water Power Bill, which was as nearly a copy of the Niagara scheme as the small water power facilities of these islands are ever likely to justify. The Bill was supported by the very best people for the purpose, both as promoters and experts. The opposition offered by the landowning and sporting interests was of the usual character, and was rightly disregarded. The object of the measure was to utilize water now running away, by harnessing it to a big electrical manufacturing plant for producing aluminium, carbide of calcium, caustic soda, and anything else susceptible of production by this means. Evidence was given to show that the Company might expect to get their electricity at a cost of £2 1s. 6d. per electrical horse power per annum, as against £8 3s. 10d. when produced by steam. The water power proposed to be utilized was estimated at 40,000-horse power, which, if sold at £4 per horse power per annum, would make a good return on a capital outlay of two millions. There was the

usual conflict of engineering testimony as to the possibility of constructing the dams and various other works for the contemplated cost; and, in the end, after hearing all that Mr. Balfour Browne could say for the promoters, the Committee declared the preamble not proved. Thus the proposed Scottish replica of Niagara was lost—and lost on the promoters' own showing, which exhibited their estimates as mere guesswork, and failed to establish the need for the sanction of the scheme in the public interest. The result is a strong condemnation of the promoters, who went to Parliament to ask for statutory sanction for what was merely a big experiment. The world therefore still awaits satisfactory proof that electricity generation in bulk is economically feasible in the United Kingdom.

British Interests and the Coal Supply.

It was briefly noticed in the "Journal" last week that the constantly-recurring topic of the quantity and consequent duration of the British coal supply had formed the subject of a Society of Arts paper by Mr. T. Forster Brown. The author must be classified among the alarmists of those who have discussed this matter before him, inasmuch as he stated the startling conclusion that "the total "supplies, at the present and prospective rate of output, "will last probably three centuries; but the cheapest will "only last half a century." Those who remember the agitation which followed the less portentous prophecy of Jevons, cannot but be struck with the absence of present public interest in this momentous question. Mr. Forster Brown is the President of the Mining Association of Great Britain; and therefore he ought to be in a good position to tell the general public all about it. Yet his authoritative communication seems to have passed unheeded. This is an age of Royal Commissions and Parliamentary Committees; but no member of either House has suggested inquiry by such means into the truth of this deduction. Not a single newspaper, to our knowledge, has impressed upon the Government or the Opposition the need for taking up this question in the national (and party) interest. Yet if Mr. Forster Brown is right, the problem of our future coal supply will enter upon the acute stage in the lifetime of many young engineers now passing out of their pupilage. He declares that the cream and the cheapest of our coal resources are being rapidly exhausted; and that the price of the best coal is bound to go up—after the expiration of fifty years at a rapidly increasing rate. What had better be done? The suggestion is that some steps should be taken during the remainder of the country's lease of cheap coal—which Mr. Forster Brown calls our "half-century "of probable prosperity"—to bring down the running expenses of the nation. The opportunity should be taken for nationalizing the railways, with the object of reducing the capital and lowering the charges for intercommunication. Instead of redeeming the National Debt, which is a process that seems to trouble the Government exceedingly, let this five or six millions a year be applied to the purchase of the railways, docks, harbours, water-works, gas-works, sewering, and all other kinds of national and municipal property. Mr. Forster Brown reckons that these properties stand the country in about 1500 millions of money. If all this indebtedness were cleared off, and the interest payments upon it to cease, the nation would be relieved of at least 60 millions of annual expenditure; "and this, upon 250 million tons of coal, represents an "amount which would more than counteract any increase "in the cost of coal due to natural causes alone, until the "practical exhaustion of our coal supplies," which would be in about another 250 years. The remedy proposed is on a sufficiently heroic scale; and it is curious to see how quietly it was taken by the meeting. Expert geologists admitted the correctness of the author's forecast, but nobody seemed to see the inevitableness of the predicted consequence of British coal becoming dearer and scarcer. Why begin to liquidate the old firm at this end? Most people would agree with Mr. Alexander Siemens, that the maintenance of the British coal supply at its present average cost is not an essential factor of British supremacy in commerce and manufactures, not to say general prosperity. Besides, there is no logical connection between the geological conditions set out by Mr. Forster Brown and the tremendous revolution in national finance which he linked up with the state of the coal measures. Why not include shipping in the list of properties to be nationalized in the name of cheap coal? Freights have more to do with the cost of coal to the consumer than railway rates. Or why not "knock the Emergency on the head" by prohibiting the exportation of British coal? The first remedy would be rather too great an addition to an already "large order;" while the President of the British Mining Association knows better than to repeat an exploded fallacy. It only remains to say that the idea of forced economy of resources is vicious. Expansion, not retrenchment, is the true rule for the perpetuation of any national greatness that is at all worthy of the name. When Britons are struck with anæmia, like the Spaniards, it will matter little whether this country produces coal or not. So long as our countrymen continue in their old way of life, they will get all the coal they want, whoever runs short.

WATER AND SANITARY AFFAIRS.

Contrary to the view taken of the subject by the Royal Commission, and contrary also to the decision come to by the House of Commons, the Select Committee of the House of Lords, presided over by Lord Ribblesdale, have announced their intention of inserting sinking-fund clauses in the Metropolitan Water Companies Bill of the Government. The opposition of the London County Council has so far prevailed in the House of Lords, though it has not achieved any other result. The County Council of Hertfordshire are to have the benefit of a clause to meet their views as to the abstraction of water from their district. Yet the Bill authorized no digging of fresh wells or enlargement of old ones; and its provisions need have caused no alarm in Hertfordshire. As for the position of the water question in the House of Commons, we discuss the progress of the East London Bills in a following paragraph; and it will be observed that the Select Committee dealing with these Bills have insisted on the introduction of the sinking-fund clauses. To some extent this might be admissible, as things go, in respect to the East London project; but the intercommunication scheme which the Government Bill seeks to authorize should clearly be exempt. In respect to the House of Commons, we have also to notice that the two remaining Bills of the County Council—namely, that for the purchase of the London water undertakings, and that for the construction of works and reservoirs in Wales—have been removed from Group D; and Mr. Harry Samuel's Bill for effecting a junction of the Metropolitan water-mains, and for other purposes, has been dropped. Of course, the two County Council Bills may reappear in a fresh group; and it will be remembered that the second reading of the Purchase Bill has been postponed to June 1.

The embarrassing and singular intervention of the Local Government Board in the proceedings of the Select Committee of the House of Commons having charge of the East London Water Bills appeared at one time to be so serious as almost to threaten the existence of those measures; and an adjournment extending over the greater part of a week took place, in order to allow the promoters—and possibly the Committee—to consider their position. It seemed as if some of the officials of the Local Government Board were zealous for the honour and credit of their chief, and conceived the notion that the Bills of the East London Company, if passed, would lessen his repute as protector of the Metropolis against the perils of drought. There was a strange letter addressed from the Local Government Board to Sir Joseph Pease, which the latter thought might be considered public property, although sent to him personally. It referred specially to the Temporary Supply Bill, and said it appeared to the Board that the greater part of the provisions of the Bill would be rendered unnecessary if the Government Bill became law. There was also a report from the Local Government Board calling the attention of the Committee to the instruction that was given to the Committee of 1896 not to confer any powers except such as were urgently necessary, nor to permit the application of any fresh capital to other than certain purposes. Upon a review of the circumstances—including the coming report of the Royal Commission—it appeared to the Committee that it was their duty not to sanction the Bills promoted by the Company, unless it were clearly shown that there was an immediate necessity for further provision in the interval between the present time and the issue of the recommendations of the Commission.

The case for consideration grew much clearer by the time the sittings of the Committee were resumed after

the interval of some days for deliberation. Mr. Bryan said that, so far as he could tell, Mr. Chaplin's Bill would only legalize the interchange of water between the Companies, and not give power to take additional water from the Thames. It did not legalize the obtaining of water by the East London Company from the Staines reservoirs—a circumstance which surprised the Chairman of the Committee. No less anomalous was the fact that the Southwark and Vauxhall Bill of last year expressly prohibited the giving of any supply under its provisions to the East London Company. This network of disablement lends much force to a passage in the interim report of Lord Llandaff's Commission, where it is remarked that "there are statu-"tory impediments to any system of intercommunication, "which require to be removed." The restriction respecting the supply from Staines is mentioned, as also that which relates to the Southwark and Vauxhall Bill of last year. The Commissioners go on to say that any Bill for establishing a system of intercommunication should make it quite clear that any Company may use their powers of drawing water from the Thames, the Lea, or any other source, as fully for the purpose of supplying water to another Company and another district as for their own district. All legislative difficulties in the way of intersale should be removed. Mr. Chaplin's Bill seems intended to give a considerable measure of freedom, though whether it has gone far enough seems to be doubtful. Thus it says concerning the Metropolitan Companies: "Nothing in any Act, whether general "or local, shall prevent any such Company from supplying "water to another Company or for another district."

All opposition and difficulties notwithstanding, the Select Committee presided over by Sir Joseph Pease decided last week that the preambles of both Bills had been proved. Mr. Pember, one of the Counsel for the promoters, expressed the opinion that the letter of the Local Government Board was "a very strong proceeding." The Chairman agreed with the learned Counsel, and remarked that some in his position might have resented the interference very much. The Local Government Board were, however, a great authority; and the Committee "had not "stood upon their dignity." The Committee did well; and the Local Government Board gained nothing. There is one point in which the Company suffer, and that is by having the sinking fund forced upon them. The Company were willing to submit a portion of the capital to this process; but the Committee insisted that the whole of the capital raised under the Bill should be included. Concerning the supply of water, Hertfordshire tried to restrict the quantity taken from the wells, while the Thames was jealously guarded by the London County Council. But water has to be obtained somewhere; and the Committee had no power to limit the supply from the wells, though it was their personal opinion that the Company should keep a record showing the extent to which the wells were drawn upon. The evidence of Sir Alexander Binnie prior to the passing of the preambles was in some respects remarkable. Admitting it was possible the Royal Commission would report that it was not necessary to go to Wales, an undertaking which would occupy from ten to fifteen years, he thought that "a very ample supply" could, with the assistance of the East London Company, be obtained from the River Thames. The Lea he looked upon as very nearly exhausted. If the Royal Commission should recommend the Thames, Sir A. Binnie considered that a supply might be obtained from that river very much cheaper and sooner than would be effected "under the "present plan." Respecting the difficulties which were encountered last year, it is satisfactory—and perhaps a little surprising—to find the Chief Engineer of the County Council saying that the experience of that year was so exceptional that it beat the record of any of the London Water Companies; going back even to the beginning of the century. As for the present situation, Sir A. Binnie considered that the scheme embodied in the interim report of the Royal Commission "was amply adequate "to meet present requirements." But, despite the admissions which appeared to favour a Thames supply, the evidence of Sir Alexander was intended to discourage the reservoirs scheme of the East London Company. Whatever he said was clearly in accordance with the policy of minimizing the powers to be granted to any of the Metropolitan Water Companies. Yet the gap of "ten "or fifteen years" must be taken as fatal to any scheme of supply framed on essentially small dimensions.

INSTITUTION OF GAS ENGINEERS.

PROCEEDINGS AT THE GENERAL MEETING,

HELD AT THE

INSTITUTION OF CIVIL ENGINEERS,

MAY 2ND AND 3RD, 1899.

Mr. F. D. MARSHALL, of Copenhagen, President.

REVIEW OF PROCEEDINGS.

THERE was a good and representative assembly of members of the Institution of Gas Engineers in Great George Street on Tuesday morning, when Mr. G. E. Stevenson opened the business meeting for the year. He lost no time in dismissing himself and yielding place to the new President, Mr. F. D. Marshall, who immediately proceeded to read the interesting and suggestive address which we published last week.

Mr. Marshall's address was like himself—thus realizing one of the prime requirements of a successful effort of the kind. The brilliant Engineer of the Danish Gas Company has owed a very great deal of his personal success to his bright natural gifts of mental flexibility and power of accommodation to his environments. Brimming over with fun, and highly endowed with one of the most precious of all qualities—a keen sense of humour—he has been able to bear lightly "as a flower" a solid equipment of chemical science and engineering judgment which have proved equal to the demands of an exacting position, occupied under conditions of expatriation which sometimes produce depressing effects. In composing his address, Mr. Marshall seems to have "let himself go" with a boyish appreciation of the opportunities presented by the task and the occasion; and consequently we get a lively running commentary upon a series of topics which are not in themselves of an amusing character. Facetious as his manner often is, however, it never descends to the farcical. One cannot object to anything he says, however much opposed to the more familiar, formal style of treatment of the dry bones of gas engineering, that "it is only Marshall." If he goes on his way gaily, he carries weight all the same.

The address, with artistic fitness, plunges at once into the central fact of the gas industry of our period—the redemption of gas lighting by Dr. Auer von Welsbach, who receives a meed of honour as full and hearty as it is deserved. Very justly, the great achievement of Dr. Auer is distinguished from the financial tyrannies which have exploited it, and have obscured both the personal merit of the inventor and the laborious industrial applications that have conquered the world of artificial light. It is, indeed, difficult to realize, as Mr. Marshall declares, what the gas industry owes to Dr. Auer, who for his part owes nothing to gas experts of his era. The story of the invention of the incandescent gas-burner utilizing the still mysterious properties of the rare earths, and its gradual but eventually supreme triumph, will continue to be told as a romance of science and industry far into the future.

The topic of incandescent lighting naturally led up to that of the street lamps and posts permitted to exhibit it in London and elsewhere. Mr. Marshall emptied the vials of his sarcasm on the London lamp-post—thus capping, with advantage, much that has been advanced on the same subject from time to time in the columns of the "JOURNAL." His cited examples of what can be done in the way of reform may not carry complete conviction; but they are undoubtedly in advance of contemporary London practice. We shall probably have to wait for a considerable raising of the standard of taste in the minds of our highway authorities before anything better will be realized in English streets. The source of the trouble lies deeper than the foundations of lamp-posts.

Mr. Marshall next passed in review the very interesting attempts now in progress on the Continent to improve the manufacture of cupola gas. He spared his audience the familiar commonplaces of carburetted water-gas *technique*; paying them the delicate compliment of starting his observations at the advanced point where the practical gas maker of the present has perforce to leave off. Thus he

contrived to touch upon a subject which has been pretty well threshed out, without going over the old ground. So he disposed of the still burning question of illuminating power, by avowing his belief that in the near future gas will be sold upon its calorific value, rather than by the conventional photometric standard which is fast becoming meaningless. It is rather a pity that, in stating the comparative cost of common sources of light, after Wedding, the address omitted all mention of the newest system of gas lighting, inwhich the combustible is burnt under assisted pressure.

One of the most important divisions of the address was devoted, very properly, to the subject of technical education. It might have been better if the word had been "scientific" instead of "technical;" but this by the way. Education in England is truly in a deplorable state. We have declared our emancipation from the old classical schooling, without putting anything really better in its place, whether elementary or advanced. Our elementary and so-called preparatory schools make a parade of "subjects," and turn out boys and girls who can neither write well nor spell correctly. We are still in the clouds for a useful substitute for the old University education, which offered unmarketable culture to those who would have it, and stamped a hall-mark of manners on all who came under its influence. The German Polytechnic may be all that Mr. Marshall's glowing fancy paints it, as a representative of the University stage of education for those who want useful knowledge as well as intellectual polish; but we have not got it. He prescribes the expedient of a "National Experimental Gas Laboratory." He will never live to see such an institution supported by the British gas industry; but what we think he might obtain at once is the nomination by the Institution of a small Committee to consider whether anything could be done for the gas industry in connection with the new National University which is to be founded in Birmingham. Here is a practical suggestion which it should not be difficult to carry out.

The description given in the address of a prize competition for gas-works design is interesting, and not least so because the English competitors were "nowhere." We should only spoil the lesson of this remarkable story of a competition which, unlike so many exercises of the kind, actually evoked something worthy of the prize, by offering any comment upon the conditions or the manner in which these were satisfied. The competition drawings were exhibited on the table, and deserved the presidential encomium on their draughtsmanship. It is to be hoped that all the competitors who made a decent approximation to a solution of the problem were recompensed for their trouble. We cannot believe, by the way, that the English neglect of the metric system had the smallest influence on the result. Naturally, the English designers had their own regular practice in mind. If metric measurements had been essential, it should have been stated in the conditions. In the meantime, Mr. Marshall's scorn of the Imperial system of weights and measures stands as an expression of personal opinion which is commonly held by business men who have dealings in metric countries. Let it be understood, as we have admitted on a previous occasion, that for business purposes a country so equipped is a Delectable Land. The obstacle to the adoption of the system in England is not touched by any such admission.

The portion of the address relating to the British gas manager's neglect of the domestic market for coke, with its reference to the pattern set by the Paris Gas Company in this respect, sounded curiously like an echo of an article that appeared in the "JOURNAL" for the previous week. We are almost disposed to commiserate with Mr. Marshall—who was in Copenhagen at the time, and had, of course, written his address before his copy of that issue of the "JOURNAL" reached him—upon this somewhat remarkable coincidence. An even stranger thing about this incident is the fact that the article in question was in type for some time before its appearance, only to be "sprung" at last, as it seemed, upon Mr. Marshall at a most awkward juncture. It is hardly necessary for us to say that nothing would have induced us to publish the article at such a time, if we had had any knowledge of what was in Mr. Marshall's mind. As it happens, however, nobody is to be pitied in this connection, inasmuch as the coincidence goes to show that more minds than one were working independently upon the same question of the hour. We owe this explanation to the President—it is, indeed, offered at his request—and we can only reciprocate the pleasure he has expressed, in his communication on the subject, that the address and our article are so strikingly in accord respecting this most important matter.

The last, but not the least, suggestive portion of the address dealt with the vexed question of Old Age Pensions. Nothing became the President more, or gave stronger proof of the advantage enjoyed by the Institution from his Continental experience, grafted upon a good English heart, than his sympathetic references to this question. The circumstance that successive Royal Commissions have failed to find a solution of the problem presented by these words does not absolve the thinkers and workers of this country from striving to discover a practical scheme of the kind, to supplement the existing Poor Law. Naturally, whenever the subject is brought forward, it is in order to refer to the German system of national insurance. Mr. Marshall characterizes this as a "beneficent enactment." It is to be hoped that the description is just; but there is only too much reason to fear that, with all its paternal powers, the German Government fails to satisfy the people with this plan. It seems impossible for the present to solve the problem of Old Age Pensions for the deserving poor on any universal principle. The English Poor Law, first systemized under Elizabeth, was such a solution for the age that produced it. Those were rough times, when "sturdy rogues" and the worthless characters whose influence has brought the operation of the Poor Law into such questionable repute, were dealt with in a fashion that is now impossible. The only hope for an improvement in this respect seems to lie in the independent action of particular industries. No better service could be done to his age or country by any technician than by the careful collection of statistics tending to facilitate actuarial treatment of the question for his special industry. We have always looked upon the Workmen's Compensation Act as a step in the direction towards which all the real friends of Labour look for the deliverance of the workman from the gulf of Pauperism. How much more of a tax upon industry would be required to compensate the workers for the accident of living until they are unable to keep themselves? That is the question. To answer it, not guesses are wanted, but first of all statistics.

Even Old Age Pensions do not close the industrial perspective. The greater question of whether the pensioner cannot become a proprietor, in his own right, of a share of the wealth created by his own labours, remains untouched by any scheme of life insurance. Here, again, the solution appears to be a point of individual devotion to the pursuit of an ideal. Profit-sharing is not reconcilable with State control, or any form of Socialism or Communistic employment. It is incompatible with Municipalization; and he would be a bold prophet who should undertake at present to predict which principle is likely to prevail in the future regulation of productive enterprise.

A few words of recognition of the President's personal obligations to the national organization of the industry which has honoured him with the bestowal of its highest office, brought to a fitting close an address which ought to bear fruit in many kinds. Our cursory remarks have not probed to their full depth the suggestive passages of this admirable effort, which will increase Mr. Marshall's reputation even with those who have long known him for one of the most advanced gas engineers of his epoch. It only adds to the regret one naturally feels that so valuable a personal force is not employed for the benefit of the home industry.

Mr. Thomas Holgate's useful paper on "Coke-Handling Plant" was the first taken; and the "actuality" of the subject was proved by the attention with which the author's compendious and critical statement of the existing practice was followed. It is not so long ago that coke was dealt with by hand labour only in all but the very largest gas-works; but the advantages of mechanically conveying and elevating this bulky and gritty material are now being generally recognized. Such papers as Mr. Holgate's are in themselves "labour-saving" devices of a high order. The reading of the paper was followed by an instructive discussion, which lasted over the adjournment.

Mr. G. P. Lewis's paper on "Retort-Heating Systems" proved to be largely a theoretical and critical dissertation on gas-producer furnaces, with special reference to the effect of steam in the primary stage of combustion. It did not lend itself to animated discussion. An important

statement on the general subject was, however, made by Mr. C. C. Carpenter; and the President and other speakers supplied the element of practical point which was lacking in the paper. Mr. Carpenter's short communication on high-pressure distribution brought the first day's business to a satisfactory close.

The Institution dinner at the Trocadero Restaurant was a great success. It was well attended; and proved one of the pleasantest functions of the kind in the history of the organization. The President is nothing if not original; and for this occasion he had prepared a pretty surprise for the company, in the form of a *menu* card which constituted the basis of a model street-lamp column for double incandescent burners, of the pattern he had recommended in his Inaugural Address.

Wednesday's business opened with Professor Vivian B. Lewes's very brilliant lecture on "Incandescent Mantles," which alone repaid the members for their devotion to a programme that cannot be characterized as otherwise than dull. Alike in matter and method, Professor Lewes's contribution to the Transactions was fully up to the standard of his own earlier performances; than which no more need be said. Mr. C. F. Botley followed with a highly elaborated statement of the working results of the Hastings pattern of carburetted water-gas plant; and the technical business of the meeting concluded with the reading, by the President, of Mr. Irminger's valuable communication on "Wind Pressure on Buildings and other Structures," which was far and away the best paper of the whole meeting.

The news of the death of Mr. Frank Livesey, which sad event occurred on Wednesday morning, cast a gloom on the Staines excursion party. The trip was otherwise the good thing of the meeting. Favoured with perfect weather, the excursion was well attended by the members; the wise rule of the Council excluding visitors, working to the general comfort. At Staines the party was welcomed by Mr. Basil Ellis, of the firm of Messrs. John Aird and Sons, and by Mr. Maurice Aird. They walked over three miles of rough ground, inspecting the interesting "navvy" work in progress on the great reservoirs which are to improve the London Water Supply, and partook of a well-earned lunch before starting on the second portion of the day's programme—the launch trip down the river. It was intended to finish the voyage at Richmond; but, by what proved to be a happy chance, lock repairs at Molesey compelled the party to leave the river here and take to the road, which led through Wolsey's Palace and Bushy Park. A small but merry dinner at the Star and Garter satisfactorily concluded a full and pleasant day.

REPORT OF PROCEEDINGS.

The General Meeting of the Institution was held on Tuesday and Wednesday, in the Hall of the Institution of Civil Engineers, Great George Street, Westminster.

Mr. G. E. Stevenson, the retiring President, occupied the chair at the commencement of the proceedings.

Annual Report and Accounts.

The report of the Council and the statement of accounts were taken as read; and, on the motion of the Chairman, seconded by Mr. C. E. Botley (Hastings), they were unanimously adopted. The report was as follows:—

The Council have pleasure in submitting their ninth annual report. They are pleased to record a continuance of the steady progress that has marked the history of the Institution since its formation. As regards the financial position, it will be seen by the balance-sheet that the money in hand at the end of the year shows a considerable increase; the Council have therefore been able to substantially augment the invested funds of the Institution in accordance with the Articles of Association.

The summer meeting held in June last year was marked by the visit paid by the Dutch Institution of Gas Engineers, who attended to the number of about seventy members. It is with great satisfaction that the Council record the success of the efforts made to receive and entertain our *confrères* from across the sea. The Council regret that no definite action was taken upon the report made by the Committee on the question of the temperature of gas measurement, submitted at the adjourned annual meeting. The amendments of the Articles of Association agreed upon at the special general meetings held on the 15th of June and the 13th of July, 1898, have been duly registered by the Board of Trade.

The autumn meeting was held at Manchester, when an opportunity was afforded of inspecting the various gas-works of the Manchester Corporation; and, owing to the efforts of the President and the members of the Corporation Gas Committee, the visit proved a great success.

The Council take this opportunity of recording their thanks to those who have contributed to the usefulness of the "Transactions," by furnishing abstracts of scientific papers and drawings and descriptions of works.

The accounts to Dec. 31, 1898, have been duly audited.

Additions to the Roll.

The following gentlemen were reported to have been unanimously elected:—

MEMBERS.

Belton, J. C., Gas-Works, Roodee, Chester.

Brackenbury, C. E., Chief Assistant Engineer, Continental Union Gas Company, and Cie. l'Union des Gaz.

Cranmer, W. G. S., Gas-Works, Shortheath, near Wolverhampton.

Fuller, W. J., Gas-Works, Bournemouth.

Hawkins, H., Gas-Works, Todmorden.

Robins, G. M., Gas-Works, Sutton.

ASSOCIATES.

Caddick, A., Croydon.

Morris, H., Jersey.

Mr. Stevenson then introduced Mr. F. D. Marshall as his successor, and vacated the chair in his favour.

Thanks to the Past-President.

Mr. W. Foulis (Glasgow) proposed a cordial vote of thanks to Mr. Stevenson for his valuable services as President during the past year. He said a great deal of the success of such an Institution as theirs always depended on the President; and he knew of no period during which they had been more successful.

Mr. W. R. Herring (Edinburgh) cordially seconded the motion, which was at once carried unanimously.

Mr. Stevenson briefly acknowledged the compliment, and expressed his gratitude for the kind support he had received from the whole of the members during his year of office.

President's Address.

The President then read his Inaugural Address, which was given in the "Journal" last week (pp. 1100-1105).

Mr. J. W. Helps (Croydon) proposed a hearty vote of thanks to the President for his excellent address. He remarked that there was an unwritten law prohibiting any discussion or criticism of it at the present moment; but he should be very much surprised if it did not arouse a considerable amount of comment in the Technical Press during the next few weeks.

Mr. G. E. Stevenson (Manchester) expressed his great pleasure in seconding the vote of thanks, and would only say that the address had produced a most exhilarating effect on his mind with regard to the status and position of the gas industry in England, and he had no doubt this was the general impression.

The motion was carried unanimously.

Reading of Papers.

The reading of papers was then commenced. They were taken in the following order:—

Tuesday.—(1) "Coke-Handling Plant." By T. Holgate. (2) "Notes on Modern Systems of Retort Heating." By G. P. Lewis. (3) "A Note on Distribution." By C. C. Carpenter.

Wednesday.—(4) "Incandescent Mantles." A Lecture by Vivian B. Lewes, F.I.C., F.C.S. (5) "The Practical Working of Carburetted Water-Gas Plant." By C. F. Botley. (6) "Wind Pressure on Buildings and other Structures." By J. O. V. Irminger.

The lecture by Professor Lewes and the papers by Messrs. Carpenter and Irminger, with the discussions thereon, will be found in another part of the "Journal." The rest will be given next week.

At the close of the discussions on Wednesday afternoon, the general business was resumed.

Appointment of Scrutineers.

The President said they had now come to a very dry portion of the business. They had Mr. A. E. Broadberry,

Mr. T. Lacey, and Mr. W. E. Price as Scrutineers. Mr. Lacey was now a member of the Council; and they must look for a new scrutineer. He proposed that Mr. Iago, of Fulham, should be elected, and that Mr. Broadberry and Mr. Price should be re-elected.

This was agreed to.

Votes of Thanks.

The President next said he had a pleasing duty to perform in proposing: "That the best thanks of this meeting be given to the authors of the papers." He hoped the members would, in the usual manner, signify their acceptance of the proposal.

Mr. C. D. Drury seconded the motion; and it was enthusiastically carried.

The President proposed that the best thanks of the meeting be given to the President and Council of the Institution of Civil Engineers, for granting the use of the room for the purposes of the meeting.

Mr. T. A. Guyatt seconded the proposition; and it was carried.

A vote of thanks was next accorded to Mr. Magnus Ohren, the Honorary Auditor of the Institution.

Mr. E. A. Harman (Huddersfield) then proposed that the best thanks of the meeting be given to the Council for their conduct of the affairs of the Institution during the past year. He said he had had the pleasure of proposing this resolution for some two or three years, and he did it with very great pleasure that day. If he might be allowed to do so at that point, he would like to make one suggestion. He thought an evening lecture would create a sort of interest for the various employees in gas-works round and about London during the annual meeting of the Institution. If a member of some profession in connection with the gas industry could deliver the lecture he suggested, he believed it would be an exceptional advantage.

Mr. A. E. Broadberry (Tottenham) seconded the motion; and it was carried.

Mr. J. W. Helps next said he had already had the pleasure of moving a vote of thanks to the President for his able address, and he had also been asked to propose the resolution that the best thanks of the meeting be given to the President for his conduct of the business of the meeting. He was sure members would be glad to accord him a hearty vote of thanks for the courtesy, geniality, and great enthusiasm of the President, which had made the meeting one of the most successful that had been held by the Institution.

Mr. Lacey, in seconding the motion, cordially agreed with what Mr. Helps had said.

The resolution was heartily received.

The President, in reply, thanked the members for the vote, and for their patient attendance during the meeting. He had still a great pleasure left to him, and that was to propose that the best thanks of the Institution be given to their friend the Secretary (Mr. Thomas Cole). It was all very well for him to preside at these meetings; but he should be a helpless individual without the Secretary. He had been his guide, counsellor, and friend; and he asked the members to accord him as hearty a vote of thanks as he (the President) did himself.

The motion having been unanimously carried,

Mr. Cole thanked the members for their cordial vote of thanks. He said his work was exceedingly pleasant, and he had always received the greatest possible kindness from every member of the Council. He was sure the Institution would go on and progress; but he should like to see a little more individual interest from the various members with regard to it. He thought every member might take upon himself a personal interest. They could not all read papers; but he should like to see more members coming in.

The meeting then terminated.

THE LECTURE.

INCANDESCENT MANTLES.

By Vivian B. Lewes, F.I.C., F.C.S.

There is nothing more wearying to the practical man than to listen to the preachings of the scientist who imagines that the thoughts born within the four walls of his study are superior to the hard-earned experience of years of labour; and nothing is farther from my intention than to impose this suffering upon you. There are, however, sides to many questions which can be made clear; details, the explanation of which can help; and innovations, the description of which will interest those employed in actual every-day work. It is in this way that lectures can be made most valuable, while the more practical working experiences find their most fitting record in the discussion which every lecturer hopes to excite.

It was long before the incandescent mantle came to the assistance of the gas engineer in his fight against the threatened encroachment of the electric light, and the name of Dr. Auer von Welsbach became known to the scientific world as one of the most promising students in the domain of the rare earths that the world-famous laboratories of Heidelberg and Vienna had produced. Boiling a solution of some of these rare oxides, and using a ragged sheet of asbestos card to shield the beaker containing the solution of the salts from the fierce flame of the bunsen burner, he noticed that a small quantity of liquid which had boiled over and evaporated on the projecting fibres at the edge of the card, endowed them with the power of becoming brilliantly incandescent under the exciting heat of a non-luminous flame. Seizing the clue so obtained, Welsbach set himself to solve the problem of how to utilize the manifestly high light-emissivity of these bodies as a practical aid to artificial illumination; and the result of his quest has been to place the gas industry well beyond the reach of electrical competition for many years to come, and to ensure fame and more substantial reward to the keen worker whose appreciation of the importance of his discovery, and determination during an up-hill fight of some ten years, have practically resulted in one of the most phenomenal successes of modern times.

The term "rare earths" is one of those anomalies which mar the vaunted precision of science; as, though it might justly be applied to the oxides of many metals, it was in 1885 used to designate a small band of metallic oxides which occur in certain rare minerals of which cerite and gadolinite may be taken as types. The term "earth" was applied to such bodies as the oxide of chromium (Cr_2O_3) and alumina (Al_2O_3); while the "alkaline earths" were the calcium and magnesium groups. These rare earths were generally considered to be—

Cerium oxide (Ce_2O_3).
Lanthanum oxide (La_2O_3).
Didymium oxide (Dy_2O_3).
Yttrium oxide (Y_2O_3).
Erbium oxide (ErO_{23}).

together with some others even scarcer; and these are divided into two groups—

Cerite Earths.	Ytterite Earths.
Cerium oxide.	Yttrium oxide.
Lanthanum oxide.	Erbium oxide.
Didymium oxide.	

which are easily divided from each other by the action of an excess of potassic sulphate; the cerite earths forming "alums," which are insoluble in potassic sulphate, and so separate out, while the ytterite earths remain in solution. These rare earths are all bases; although there are other metallic oxides equally rare which play an important part in mantle making, but cannot be classified with them. Thoria (ThO_2) and zirconia (ZrO_2) are not earths, and in some combinations show rather an acidulous than a basic tendency. These two metals, thorium and zirconium, are classed with titanium, silicon, &c.

It was with the study of these oxides that Welsbach was most concerned at the period when his early attempts began to assume tangible shape; and having discovered the possibility of making a mantle to fit the shape of a non-luminous bunsen flame by soaking a cotton fabric in a solution of salts of the rare earths, and then burning out the organic matter in such a way as to leave a ghost of the departed threads built up of the oxides of the metals used—thin enough to be excited to luminosity by the heat of the flame, and yet resistant enough to retain its shape under the temperature to which it was submitted—he took out his celebrated patent of 1885, which has proved an efficient first line of defence against those who, left outside the charmed circle, have yet hungered for the baked meats within.

In the 1885 patent, Welsbach protects the idea of

making a mantle by saturating the cotton fabric and then burning off, using mixtures of the salts which he gives as—

"60 per cent. of zirconia or oxide of zirconium.
20 ,, ,, oxide of lanthanum.
20 ,, ,, oxide of yttrium.

The oxide of yttrium may be dispensed with; the composition being then—

50 per cent. of zirconium.
50 ,, ,, oxide of lanthanum.

Instead of using the oxide of yttrium, ytterite earth, and instead of the oxide of lanthanum, cerite earth containing no didymium and but little cerium, may be employed."

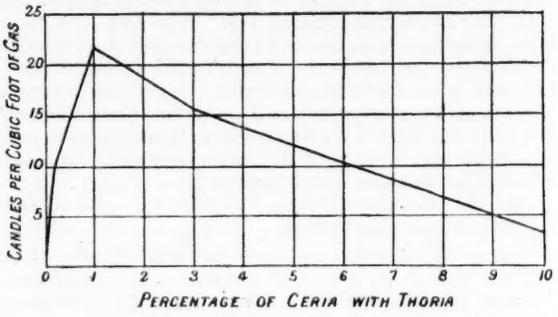
As a commercial article, the mantles made under this patent were dire failures. They had an illuminating power which varied from 3 to 6 candles per cubic foot of gas consumed, and were so friable that the mantles of to-day seem giants of strength as compared with their puling forefathers. They, however, fulfilled the important function of launching the idea of the mantle. Hardly had the patents been taken than Welsbach made the further discovery that, by going outside the group of rare earths, and by replacing zirconia by thoria as a basis, increased life and strength could be given to the mantle; and this was protected by the patent taken out by him in 1886. In this patent he protects the use of thoria alone or in admixture with zirconia, lanthana, yttria, didymia, erbia, magnesia, or alumina.

During the next few years, the composition of the mantles made by the Welsbach Companies was of a very variable character; but the largest proportion of them consisted of commercial thoria, and gave a light of 6 to 8 candles per cubic foot of gas—this being due to the fact that the material used was not pure, and contained traces of ceria, which gave it the power of emitting what was then a considerable amount of light. Pure thoria gives a practically non-luminous mantle; and with chemically pure material the light obtainable is under 1 candle per cubic foot of gas; while even now a mantle made from the commercially pure thoria, manufactured for mantle making, gives a light of from 4 to 5 candles per cubic foot. This is entirely due to the difficulty of separating the last traces of ceria; and as 0·1 per cent. of ceria causes thoria to give about 5 candles per cubic foot of gas, it is difficult to obtain a sample which does not give a certain amount of light.

The use of ceria together with thoria is mentioned in some of Welsbach's early foreign patents; but the exact date at which it was first realized that traces of ceria had the marvellous effect on the light-emissivity of the thoria mantle that we find in the mantles of to-day, is not very clear. It is evident, however, that the advantage of the presence of small quantities of ceria was beginning to be realized by 1891, when Mr. W. Mackean, the Chemist of the English Welsbach Company, read a very interesting paper before the Society of Chemical Industry,* and pointed out that ceria is by no means a disadvantage in small quantities, as it adds to the constancy of the illuminating power. He gave a table showing the influence of the presence of ceria in the lighting fluid, and also the influence upon the light which increasing percentages of ceria have. Thus, for instance, the ordinary lighting fluid contains 0·25 per cent. of ceria, and gives 25 candles for a consumption of 2½ cubic feet of gas, or 10 candles per foot; while increasing the percentage of ceria in the fluid to 0·5 reduces this to 18 candles for 2½ cubic feet. When 1 per cent. of ceria is added, a further reduction to 13½ candles for the 2½ cubic feet is found; but while the candle power lost 43·2 per cent. in 1000 hours with the 0·25 per cent. of ceria, it only lost 12·6 per cent. in one experiment, and 28 per cent. in another, with 1 per cent. of ceria present in the original fluid. He also, in the same paper, gave the following as a composition for a mantle giving a yellowish light: Lanthana, 40 per cent.; thoria, 28 per cent.; zirconia, 30 per cent.; and ceria, 2 per cent.—showing that at this period the use of small quantities of ceria in mantles containing thoria was by no means unknown.

Later on, in 1893, Mr. Moeller, having clearly realized that commercial thoria contained traces of ceria, and that it was owing to this that the earlier mantles gave any light, took out a patent in which he sought protection for thoria in combination with very small traces—not exceeding 1 or 2 per cent.—of certain other rare metals, such as uranium, cerium, terbium, neodymium, samarium, praxeodymium, yttrium, and lanthanum. The mantles of to-day nearly all consist of 99 per cent. of thoria and 1 per per cent. of ceria, as, although several of the oxides mentioned, in minute traces, endow a non-luminous thoria mantle with the power of emitting light, yet ceria so far transcends the others in its capacity of not only exciting luminosity but of keeping up the illuminating power over a long period, that, as far as our present knowledge goes, it is needless to look beyond it.

An absolutely pure thoria mantle gives less than one candle per cubic foot of gas consumed; a pure ceria mantle gives but little light, and of a red nature. So that, for all practical purposes, the ingredients when used alone are valueless. But the smallest addition of ceria to the thoria causes a rapid leap up in its power of light-emissivity, which reaches its maximum when from 0·9 to 1 per cent. of the total oxide consists of ceria. Further additions cause a rapid falling off in the light; while the light emitted first assumes a yellowish and then a reddish tint as the percentage increases. The following curve of candle power and percentage of ceria shows the average result obtained; but it must be borne in mind that certain traces of impurities derived from the ash of the cotton and from the salts used lower to a certain degree the absolute candle power, although they do not affect the general contour of the curve.



Curve showing the Effect of Percentage of Ceria on the Light Emitted by a Thoria-Ceria Mantle.

Several attempts have been made to explain the wonderful power of light emissivity possessed by the thoria-ceria mantle. Dr. Drossbach was of opinion that the rare earths had a special action in converting heat rays into light rays, and that the molecules of ceria acted by bringing the heat vibrations of thoria to the most favourable state of resonance with the vibrations of the hot-flame gases. Dr. Moscheles and Dr. Killing both pointed out that cerium formed two oxides, and that other metals having the same characteristics would act as exciters when used in the proper proportions. Both attributed the high incandescence of the mantle to changes in the state of oxidation increasing the intensity of combustion on the mantle surface; while Dr. Killing pointed out that a catalytic action also probably took place. Dr. Bunte has given by far the best exposition of the theory of the incandescent mantle, which, if it does not make all points clear, yet offers a simple and probable explanation of the observed phenomena, which he ascribes to intense local temperature due to the ceria exercising a power of attracting oxygen and causing its combination with the flame gases.

The remarkable influence which ceria exerts in awakening light emissivity in the mantle, becomes still more remarkable when one considers that, although the percentage by weight of the ceria is only one, yet that by volume it is enormously less. When nitrate of cerium is converted into ceria by the action of heat, little change of volume takes place; but when nitrate of thorium is decomposed in the same way, its conversion into oxide is accompanied by an increase in bulk of an extraordinary character—the substance swelling up, and producing a light powder occupying many times the bulk of the original salt—so that in the finished mantle small indeed must be the space occupied by the exciting ceria.

This seems to point to some specific action on the part of the ceria; and cases are not unknown in which dilution with some inert material increases physico-chemical action of the kind one would expect of the ceria. If port or claret be shaken up with powdered charcoal, which consists

*See "JOURNAL," Vol. LVII., p. 345.

of nearly pure carbon, and the mixture is then filtered, the colour is but little changed; while if animal charcoal, or some of the artificially prepared imitations of it containing only 10 per cent. or less of carbon distributed over the surface of inert mineral matter, be used for the same purpose, the liquid is absolutely decolourized.

Another example which bears closely upon the case of the ceria, is to be found in the action of platinum upon mixtures of hydrogen or coal gas and air. If a piece of platinum foil be heated to redness in a bunsen flame, and the gas be then turned out and afterwards turned on before the platinum has had time to grow too cool, it again becomes heated to redness in the stream of gas and air, and continues in this condition as long as the gases are passing over its surface; while if brought to what would have been the outer envelope of the flame had the gaseous mixture been alight, the temperature is so increased that the ignition-point of the gas is reached.

The action here is what is known as a catalytic or surface action; and it is due to the fact that platinum has the power of condensing gases upon its surface, and in doing so renders them so chemically active that combination between the condensed gases is often induced. In the cases of the coal gas and air, enough heat is evolved on the surface of the platinum to raise it to redness. The result being due to surface action, it is manifest that an increase of the surface must increase the activity of the substance; and if, instead of taking metallic foil with its comparatively small area of exposed surface, spongy platinum made by reduction from a platinum salt or asbestos coated with the reduced metal be employed, ignition of the gaseous mixture without the preliminary heating takes place.

The fact that the platinum foil remains red hot in the stream of coal gas and air which is only at atmospheric temperature, at once shows that the heat evolved by such an action is localized in the body starting the action; and it is manifestly possible—and indeed probable—that the very minute particles of ceria scattered over the surface of the inert thoria, and so subdivided as to be capable of easy and rapid heating to a very high temperature, may give rise to an action of the same kind. Indeed, one knows that to a certain extent this is so, because if the mantle-burner be turned off and again turned on while the mantle still remains hot, the mixture of gas and air is re-ignited, though the rod and mantle material are manifestly below the ignition-point of the gas; and the fact that this does not take place with a pure thoria mantle, is a fairly good proof that it is the ceria, and not the thoria, which is acting.

Dr. Bunte has found that thoria had no influence in bringing about the combination of hydrogen and oxygen, and the temperature at which the two combined to form water was the same whether thoria was present or not; but that the presence of ceria caused them to combine at 660° Fahr., instead of at 1200° Fahr. This being so, the question arises as to what the action can be that the ceria induces, the localization of the heat from which causes its minute and subdivided particles to glow with so high an incandescence.

When in a bunsen burner the admixture of gas and air has been carried to the extreme limit, so that what would have been the inner cone of the bunsen flame settles down as a green and seething sheet on the gauze of the burner top—being, indeed, only prevented from flashing back in the tube by the conducting power of the gauze and the accelerated rush of the gas and air mixture through its meshes—the combustion is being completed in two stages; the first taking place on the surface of the gauze, where the hydrocarbons of the coal gas undergo incomplete combustion at the expense of the oxygen of the admixed air, yielding carbon monoxide and hydrogen, together with small quantities of carbon dioxide and water vapour. It is the combustion of the carbon monoxide and hydrogen which gives the outer flame in which the mantle is heated; this combustion entirely taking place at the expense of the oxygen derived from the air surrounding the flame, and not from the air originally mixed with the gas in the burner-tube. It is a mistake to speak of this outer flame as a "solid flame"—an expression often used in connection with burners in which sufficient air is introduced with the gas to flatten the inner zone on to the gauze—as it is merely the structureless flame which is always obtained on burning gases like carbon monoxide and hydrogen, which burn only in one stage. Any user of mantles knows perfectly well that it is only in the edge of this outer flame that the mantle material acquires its true incandescence; this being due to the fact that it is only when the maximum quantity of air and the carbon monoxide and hydrogen meet that the highest temperature is attained, as it is here that combustion is at its fiercest, and that the catalytic action of the ceria creates points of high intensity.

The view put forward by Morscheles and Killing may be shortly stated as follows: Cerium is a metal which exists in two states of oxidation—a lower or cerous oxide Ce_2O_3, and the higher or ceric oxide CeO_2—and it is easily conceivable that in its highly subdivided condition, and at a high temperature, exposed as it is to the high reducing action of hydrogen and carbon monoxide, which tend to take oxygen from it and convert it into cerous oxide, and also to the oxidizing action of the air, which tends to again build it up into ceric oxide, a continual oxidation and reduction is taking place; the abstraction of oxygen from the air, and its liberation to combine with the reducing gases on the surface of the ceria, raising these attenuated particles far above the temperature of the flame. It is quite clear that, whether one accepts the Killing theory of dual oxidation or Bunte's of catalytic action of the ceria, one arrives at an explanation of the fact that, unless the mantle be just in the right position so that both the air and flame gases have access to it, the luminosity of it is practically destroyed.

It may be roughly stated that there now exist two classes of theory with regard to the mantle. The first is that the ceria or ceria and thoria exercise some occult power of converting heat rays into light. The second, the theories of Killing and Bunte, which ascribe the wonderful light-emissivity to the exalted temperature brought about by local combination due to the power of the ceria in attracting oxygen; and it matters little whether this be brought about by a purely chemical or by a physico-chemical action.

It is clear that if the light be due to the conversion of heat rays into light, on heating the material out of contact with air, the same differences in their power of emitting light should be observed as exist in the mantle; and several experiments have been made in order to find if this were so or not. Dr. Bunte took a thick walled tube of arc carbon, having the walls of its middle portion reduced for a length of 4 inches to a thickness of 0·059 inch, and heated it by an electric current until the middle portion attained a most intense white heat, far above 3630° Fahr. In order to prevent combustion and loss of heat, the middle of the tube was embedded in magnesia, over which asbestos paper was wrapped. Small square prisms—0·59 inch long by 0·28 inch wide—of magnesia were coated with the substances to be examined; and each was cemented to a similarly shaped piece of carbon or magnesia, so that the two adjoining faces consisted of the two substances to be compared. On placing these double prisms in the tube, it was possible, with certain precautions, to observe the relative intensities of the radiation by comparing the two halves of the surface visible in the tube. These researches showed very small differences in the intensity of the radiation from carbon, magnesia, pure oxides of thorium and cerium, and the Welsbach mixture.

Within the last week confirmation has been given of Dr. Bunte's results by an extremely interesting paper communicated to the Royal Society by Mr. A. C. Swinton, in which he enclosed the luminous materials in a vacuum tube, and subjected them to bombardment by means of cathode rays, which would raise them to a very high temperature, as it is possible by such a method to melt platinum and glass, and to bring finely divided carbon to bright incandescence. The mantle to be experimented on was mounted in a platinum wire frame, and placed between the two electrodes, so that as the electric current alternated, and each electrode became in turn the cathode, the mantle was subjected on alternate sides to cathode ray bombardment. Experiments were made with mantles consisting entirely of ceria and thoria, both separate and mixed in different proportion; and in order to obtain accurate comparisons between the pure oxides and different mixtures, the mantles were made in patchwork—each mantle being made up of two to four sections separately impregnated with different solutions, and then sewn together with impregnated cotton before being burnt.

With a compound mantle prepared in this special way,

composed one-half of pure thoria and the other half of a mixture of 99 per cent. thoria with 1 per cent. ceria, it was found that after exhaustion, on starting the cathode discharge, the thoria *plus* ceria heated up to incandescence more rapidly than the pure thoria, and on stopping the discharge cooled more rapidly. Further, when at full incandescence, and observed through a dark glass, the thoria *plus* ceria was slightly more luminous than the pure thoria, though the difference was very small—probably not more than 5 per cent. Owing to the difficulty of obtaining a constant vacuum, accurate photometric measurements were not possible; but the amount of light under favourable conditions was roughly estimated at at least 150-candle power per square inch of incandescent surface—this being obtained with an expenditure of electrical energy in the secondary circuit, at about 8000 volts pressure, of approximately 1 watt per candle. The amount of exhaustion suited to give the best results varied with the dimensions of the tube and the conditions mentioned in the paper, but was approximately about 0·00005 atmosphere; the maximum luminosity being obtained when the dark spaces of the two cathodes just crossed at the centre of the bulb. Owing to the large amount of gas occluded by the mantle, a proper degree of permanent exhaustion was very difficult to arrive at, and required continuous pumping for many hours with the cathode rays turned on at intervals. Even then, the conditions of maximum luminosity were exceedingly unstable, owing, on the one hand, to the further liberation of occluded gas, and, on the other, to the rapid increase in the degree of exhaustion on account of absorption of the residual gas by the electrodes. That such absorption probably took place in the aluminium electrodes, and not in the mantle, was demonstrated by other experiments with a tube in which there was no mantle, but only two electrodes of aluminium wire.

These experiments all point to the fact that the idea of a mixture of 99 per cent. of thoria and 1 per cent. of ceria having the peculiar power of converting heat rays into light, while thoria and ceria alone have not this power, or at any rate only have it to a very limited extent, is not tenable; otherwise the same difference would have been noticed when the materials were heated either in the carbon-tube furnace or in the vacuum tube. This undoubtedly gives great support to the second theory.

It has been pointed out that the amount of ceria in the mantle is so extremely small that it seems hardly credible that any surface action that it possessed would play an important part in the production of luminosity; but Dr. Bunte answers this objection by saying that, according to Davy's theory, the illuminating power of an ordinary gas-flame is due to the particles of carbon which are separated from the gas and raised to a white heat. The carbon arises chiefly from the decomposition of the heavy hydrocarbons ethylene and benzene, which form together about 5 per cent. of the volume of the gas. Assuming, for the sake of simplifying the calculation, that all the carbon of the benzene and half that of the ethylene is separated and heated to incandescence in the flame, it may be calculated that about 54 milligrammes of carbon are separated from a litre of good coal gas—23·6 grains from 1 cubic foot. Thus 4 per cent. of ethylene and 1 per cent. of benzene give, per litre of gas, 60 c.c. of carbon vapour from the benzene and 40 c.c. from the ethylene—in all 100 c.c., which is equal to about 54 mg. of carbon. The volume of the luminous portion of a flame having a consumption of 5·297 cubic feet per hour, and an illuminating power of 17·5 candles, is about 2 c.c. at 32° Fahr. There is therefore in it $(2 \times 54) \div 1000$ mg., or 0·1 mg. (0·0015 grain) of incandescent carbon. Such an extremely small quantity of incandescent carbon as 0·0015 grain, gives the luminous surface to the gas-flame, and emits a light of 17·5-candle power. Now the 1 per cent. of ceria in the Welsbach mantle amounts to about 4 mg. (0·06 grain) per mantle, or about forty times the quantity of incandescent carbon in an ordinary flat flame. The quantity is therefore quite sufficient to explain why the Welsbach burner may give a light of 60 candles, while the flat-flame or argand burner furnishes only 17·5 candles.

The only other legalized mantle at present before the public is the Sunlight, the ingredients of which consist of alumina and the oxides of chromium; and it is interesting to see how far the light yielded by this mantle can be attributed to the same action as in the case of the Welsbach. If a mixture of alumina or alumina and zirconia, with a very small percentage of chromium, be employed, a very high candle power is produced, which, however, soon dies away, owing to the volatilization of the chromium compound; while if the amount of chromium present be increased, the mantle acquires a more ruddy light, and retains its illuminating power for a much longer period. So that with a proper percentage of chromium a candle power of 10 to 11 candles per cubic foot of gas can be obtained for a period of 400 to 500 hours; and it is noticed that the chromium, which on first burning shows as green chromium oxide, rapidly combines with the alumina to form a pink compound, which has much the same composition as the ruby. It is quite probable that the increased life given by the larger quantity of chromium is due to the fact that the lighting power of the mantle is really dependent on small traces of the oxide of chromium; and that as this gradually volatilizes off from the surface of the mantle, some of the pink compound gets dissociated by heat, and supplies a fresh portion of chromium oxide to the surface of the mantle—this pink compound being far less volatile than the chromium oxide itself.

Thoria, as far as the life of the mantle goes, is perhaps the most important constituent, as there is no other known oxide which will stand heat for so long a period without being affected by it; and the getting away from shrinkage in the mantle was one of the chief steps which led from the failure of the early mantles to the success achieved by the later ones. Moreover, thoria is a body having a very low specific heat; and owing to its bulk when produced from the nitrate of thorium by the action of heat, it is a good non-conductor, so that the temperature created on the surface of the ceria particles is more readily localized.

Within the last few years attempts have been made to attack the question of mantle making from a different standpoint. Admitting the superiority of thoria with its 1 per cent. of ceria over other mantle mixtures, efforts have been made to obtain mantles of filaments of this mixture upon the principle under which the old Clamond basket was made. Clamond produced his incandescents by making a paste of magnesia with acetate of magnesia in solution, and moulding the mixture into threads by squeezing through holes in a plate. The threads, while plastic, were wound to the required shape on a mandrel or mould—the still moist threads being pressed together and made to cohere at the points where they crossed each other; and then, on baking, the acetate luting burnt to oxide. The reduction in size of the mass to be rendered incandescent was a great advance, and enabled incandescence to be produced by a burner instead of a blow-pipe; while Welsbach's discovery—or rather adaptation—of the principle of saturating a fabric and incinerating, created a new era in incandescence.

As was natural, attempts were then made to reduce still further the size of the filaments in the Clamond basket; and on Nov. 4, 1890, Lungren patented a distinct advance. It was found that if one made a plastic filament as Clamond had done, but finer in substance, it dried very quickly; and on attempting to make the material cohere at the crossing of the threads, those first wound on the mandrel (being drier than those wound across them) were harder, and on pressure being applied cut through the softer threads instead of welding with them. Finding this, Lungren patented the idea of making a plastic mass of some elastic material charged with refractory earths or metallic oxides; expressing from such mass fine wires or threads, weaving or interlacing the threads into a fabric from which the cone or mantle could be made, and then burning out the combustible elastic binder. In making this binder, he gives mixtures of glue with glycerine, india-rubber dissolved in naphtha, or boiled linseed oil as examples; but he also says that a variety of materials may be used.

One of the most remarkable developments of the last fifty years has been the wonderful way in which the lower form of guncotton, known as collodion cotton, has been utilized for commercial purposes; and at the present time it bids fair to invade the territory of incandescent mantle making. It was in 1838 that the chemist Pelouze drew attention to the fact that when paper was acted upon by the strongest nitric acid it increased in weight, and acquired the property of burning with enormous rapidity; while as early as 1813 Braconnot had prepared a substance called "xyloidin," by acting upon starch, linen, and sawdust in the same way. It was not, however, until 1845 that any serious attention was directed to the use of such

substances as explosives, when Schonbein first called attention to nitrated cotton wool, and advocated its use as a substitute for gunpowder—showing that in explosive energy it was far superior to it.

Experiments were at once instituted on a large scale; and its manufacture was carried on in England, and also on the Continent. But in 1847 a very serious explosion occurred at the works at Faversham in which it was manufactured by the Messrs. Hall; while a year later an even more serious explosion followed in the guncotton factory at Bouchet, near Paris. As no reason could be assigned for these and similar explosions, gun-cotton was looked upon as too dangerous an explosive for ordinary use; and its manufacture was for a time discontinued.

During this brief period, however, it had been discovered that if the strength of the nitric acid employed in the manufacture be slightly reduced, a compound was formed which had the property of dissolving in a mixture of alcohol and ether, which was not the case with the true gun-cotton; and that on allowing the solvent to evaporate, a semi-transparent mass was left in which no trace of the structure of the original material remained. This solution was eminently adapted for forming thin films on glass plates; and as this was a great desideratum at that particular period for photographic purposes, the new material began to be manufactured on a fairly large scale. It was soon found that, by slight modifications in the method of manufacture, and by loading it with various foreign materials, excellent imitations of amber, ivory, and tortoiseshell could be obtained, with the result that the manufacture of collodion has now attained very considerable importance.

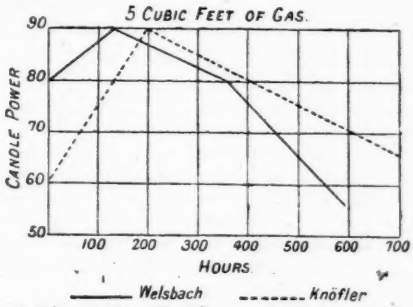
One of the most beautiful applications of collodion is the manufacture from it of artificial silk. In the interesting, but little known, town of Besançon, the French inventor Chardonet has established a large manufactory in which collodion, made by nitrating wood pulp, is dissolved in the smallest possible quantity of alcohol and ether; and the emulsion is then squeezed out under a pressure of 750 lbs. to the square inch through capillary glass tubes, the clearway of which is less than one-hundredth of a millimetre. This enormous pressure is required to cause the material to flow evenly through the excessively small apertures. The filaments from ten to twelve of these tubes are then twisted and wound on to a bobbin, in a machine of the same character as is used for the spinning of silk fibre. The air of the room in which this operation is carried out is kept at a sufficiently high temperature to cause the instantaneous setting of the filaments, owing to the evaporation of the alcohol and ether; so that within three or four inches of the tube from which the material is issuing it has lost all stickiness, and may be twisted without cohesion between the threads. These have all the appearance of silk, but have one serious drawback that, being practically a low form of guncotton, they are excessively inflammable, and burn with a violence only a little removed from that of true guncotton. In order to overcome this trouble, the skeins of artificial silk are soaked in ammonic sulphide, which has the effect of what is termed "denitrating" them, and converting them once more into cellulose; so that, after washing and drying, the material prepared is not more inflammable than an ordinary fabric. This material is capable of taking every shade that the dyer's art can impart to it, and forms a most beautiful and wonderful imitation of silk—lacking only to a slight degree the elasticity found in the original article.

This extremely beautiful process was brought to perfection by Chardonet, and protected by him during the period which extended between 1886 and 1893; and in 1894, De Mare took out a patent for making incandescent filaments by charging collodion with metallic salts and oxides, squeezing into threads, weaving, and burning. In this patent, however, he makes no mention of denitrating the collodion filaments before burning, which would render it extremely difficult to make a mantle according to his patent. In 1895, Knöfler patented the manufacture and denitration of collodion threads or filaments loaded with oxides or salts; and in his first claim he mentions that the filaments may be "individual, or spun and eventually wrought or woven threads, which are made after the manner of the so-called artificial silk." Later on Plaissetty took out a patent which differs from Knöfler's only in that he uses glacial acetic acid as the solvent for his collodion cotton, and, instead of denitrating with ammonic sulphide, employs a solution of sulphide of lime, which, however, has the drawback of leaving a trace of lime as an impurity in the finished mantle.

Mantles made by such methods as those devised by Knöfler and Plaissetty are developments of the Clamond hood and not of the Auer mantle; the difference being that whereas the Clamond class consists of filaments of even density made by squeezing a plastic material into rods or threads, which, after the binding material has been burnt off, leave a uniform mass of oxide, the Auer class consists of filaments having a dense central portion surrounded by a more or less spongy coating, due to the fact that the soaked fabric on burning-off leaves the oxides produced from the interior of the capillaries in a dense state, while the salt on the exterior of the cotton, in its conversion into oxide by heat, is rendered spongy by the escape through it of the gaseous products of the combustion of the cotton. Consequently, if a section of one of the filaments constituting the strand could be examined under the microscope, the appearance would be somewhat as follows:—

AUER CLASS. CLAMOND CLASS.

The physical effect of this on the mantle is that the Clamond class are harder than the Auer, and do not show the same high incandescence until the surface of the filaments has become eroded by burning for a short period; the life of the Clamond class, however, when made of the same material as the Auer, being longer. For instance, two mantles, one made by the Knöfler and one by the Auer method so as to yield an ash containing 99 per cent. of thoria and 1 per cent. of ceria, would give curves of the following character:—



The total life of the Knöfler and Plaissetty mantles is probably one-third longer than that of the Auer mantle.

There seems to be every probability that mantles of the Knöfler and Plaissetty type will play an important part in incandescent lighting, as in Paris the Welsbach Company have acquired the patent rights of the process, and are introducing an innovation upon it. On taking a collodion mantle and heating it in a drying-oven for a certain length of time, considerable shrinkage takes place; and if this shrunk mantle is then put upon a burner and burnt off, the fabric rapidly moulds itself to the form of the flame with but little manipulative aid. For street lighting and for maintenance work, it would manifestly be a great convenience to do away altogether with the collodionizing, which always to a certain extent impairs the light-giving power of the mantle.

Another new feature which has been introduced into mantles of this class is to do away with the asbestos thread and loop, which has always been a weakness in the fabric, and make the strangulation at the top of the mantle by sewing it round with fibres of the same character as those of which the mantle itself is composed; this constricted annulus then resting upon a supporting ring, which is fixed as the ordinary support in the centre of the mantle. The asbestos thread has always weakened the top of the mantle, owing to the difference in the rate of contraction during burning off; and with a mantle merely resting on a supporting ring in this way, it is possible to get what really is an anti-vibrating arrangement, which materially enhances the life of the mantle for outside work.

The matter which I have brought before you has already occupied so much time that I do not propose to go into the question of burners. Many highly vaunted improvements

have been introduced during the last two years; but they have all been based upon the idea first introduced by M. Bandsept, of getting the proper admixture of the maximum of air and gas to be burnt at the bottom of the burner, and perfecting and completing the mixture close to the mouth of the burner, where the combustion is to take place. In many cases, the increased luminosity given by such burners is really due to the length of tube, the increase of which acts in the same way as increase in gas pressure. These improved burners have shown themselves to be extremely variable; for while, with carefully adjusted samples and careful manipulation in the laboratory, it has been possible to get as much as 25 candles per cubic foot of gas with a properly prepared Welsbach mantle, in practice on a big scale the duty given is quite as often 17 candles or less. The old Bandsept burner, when properly made, is still as good as, or better than, the new ones.

The PRESIDENT said he was sure they were all deeply indebted to Professor Lewes for the interesting lecture he had delivered—one of the most interesting they could possibly listen to. They were also deeply indebted to M. Plaissetty for having taken the trouble to come over to this country, and bring with him the beautiful materials they had seen. If there were any questions which members would like to ask Professor Lewes, he was sure the Professor would be pleased to answer them.

No question being put,

The PRESIDENT asked the members to show their appreciation of the lecture in the usual way.

The proposal was received with loud applause; and Professor Lewes bowed his acknowledgments.

PAPERS AND DISCUSSIONS.

A NOTE ON DISTRIBUTION.

By C. C. CARPENTER, of Vauxhall.

At the meeting of this Institution held last June, a paper upon a subject of great interest—viz., "A High-Pressure System of Distribution"—was read by Mr. Fletcher Stevenson. In the course of the discussion which followed, the author of the present communication was able to furnish some particulars of a high-pressure plant worked during the preceding winter at one of the South Metropolitan Company's stations. It is hoped that the interest then evinced in the subject, and the importance of it to gas suppliers generally, may justify the time appropriated to its further consideration.

The productiveness or money-earning capability of the distributing mains stands upon a different basis from that of nearly all the other plant of a gas undertaking. During the winter period of greatest consumption, the whole of the manufacturing plant may be in regular daily and continuous use, and the holders likewise may be drawn upon for the entire range of their capacity. On the other hand, the distributing mains are only fully at work for from about one-fifth of the day in midwinter to one-twelfth in midsummer. Therefore capital expenditure incurred to meet the extra requirements of the hours of heavy consumption is only remunerative in the proportion they bear to the whole year.

The ideal of all supplies of energy from central stations—viz., a level load line—is not brought nearer of attainment in the case of gas by the rapid extension of its use for heating and power. In midwinter there will be an overlapping of all three demands, though not so serious in the case of the last. An average daily consumption curve for the South Metropolitan Company is shown in Diagram No. 1. In order to meet the variations indicated, three courses are open: (1) To make the mains large enough to carry the maximum consumption with a certain minimum

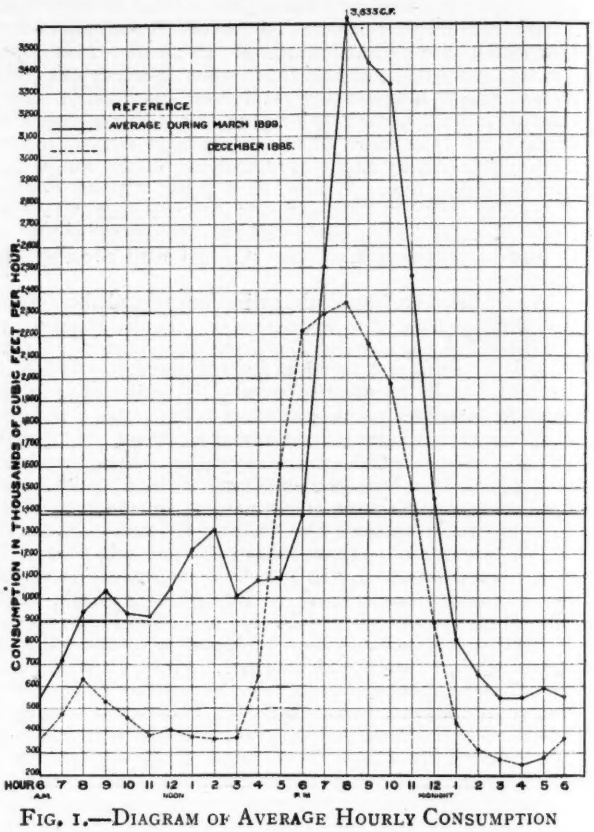


FIG. 1.—DIAGRAM OF AVERAGE HOURLY CONSUMPTION

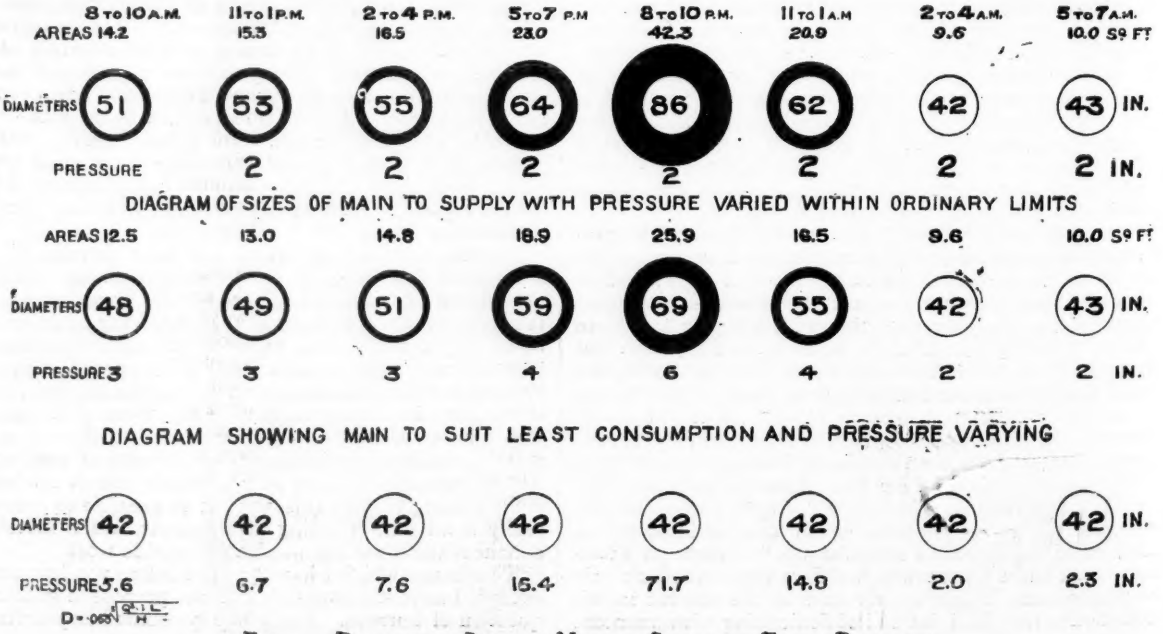

8 TO 10 A.M. | 11 TO 1 P.M. | 2 TO 4 P.M. | 5 TO 7 P.M. | 8 TO 10 P.M. | 11 TO 1 A.M. | 2 TO 4 A.M. | 5 TO 7 A.M.
AREAS 14.2 | 15.3 | 16.5 | 23.0 | 42.3 | 20.9 | 9.6 | 10.0 SQ FT
DIAMETERS 51 | 53 | 55 | 64 | 86 | 62 | 42 | 43 IN.
PRESSURE 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 IN.
DIAGRAM OF SIZES OF MAIN TO SUPPLY WITH PRESSURE VARIED WITHIN ORDINARY LIMITS
AREAS 12.5 | 13.0 | 14.8 | 18.9 | 25.9 | 16.5 | 9.6 | 10.0 SQ FT
DIAMETERS 48 | 49 | 51 | 59 | 69 | 55 | 42 | 43 IN.
PRESSURE 3 | 3 | 3 | 4 | 6 | 4 | 2 | 2 IN.
DIAGRAM SHOWING MAIN TO SUIT LEAST CONSUMPTION AND PRESSURE VARYING
DIAMETERS 42 | 42 | 42 | 42 | 42 | 42 | 42 | 42 IN.
PRESSURE 5.6 | 6.7 | 7.6 | 15.4 | 71.7 | 14.0 | 2.0 | 2.3 IN.

FIG. 2.—DIAGRAM OF SIZES OF MAIN TO SUPPLY AT EQUAL PRESSURE.

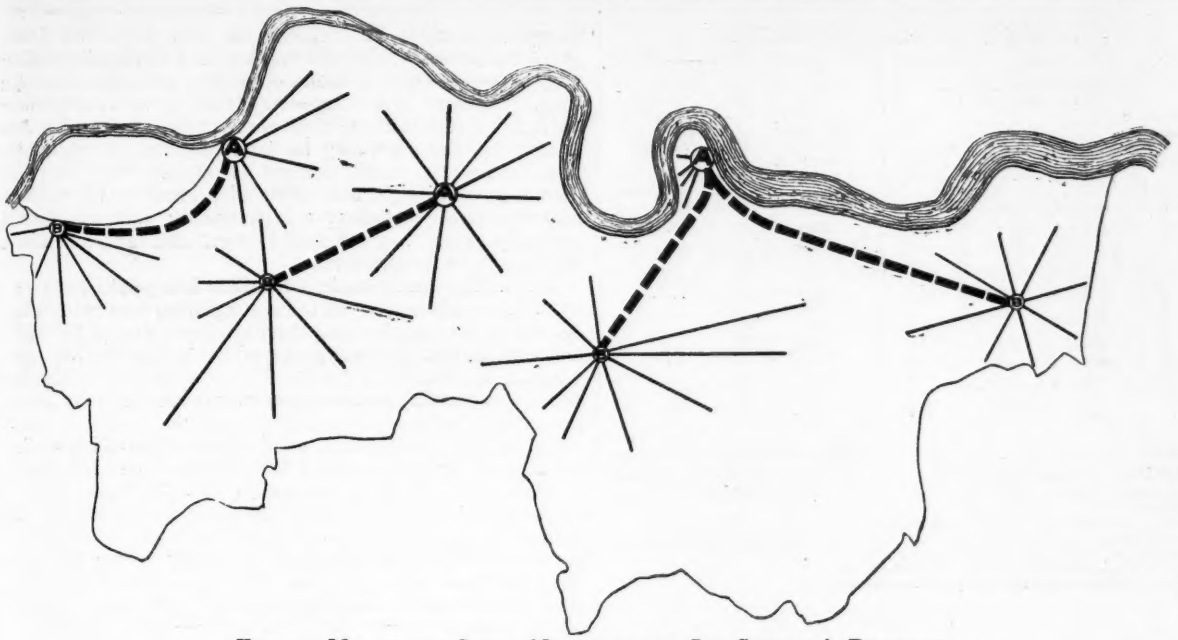


FIG. 3.—MAP OF THE SOUTH METROPOLITAN GAS COMPANY'S DISTRICT.
A. Main Distributing Stations. B. Sub-Distributing Centres.

pressure; (2) to make them suitable for the normal consumption, and increase the pressure to supply the maximum demand; or (3) a combination of both. On Diagram No. 2 are shown the sizes of mains and the initial gas pressure required for the average day shown in diagram No. 1, and calculated for one mile in length. This brings out clearly the advantages of high-pressure gas in reducing expenditure on mains.

The scale Diagram No. 3 shows the application of the system of high-pressure supply to the district of the South Metropolitan Company. The larger works are shown at A A; and from their controlling governors the high-pressure mains run to the distributing centres B B. The initial pressures are so arranged as to give about 3 inches at these points (governors not being required), and any excess over the proper limit acts as "back-gas" in reducing the quantity sent out by the lower-pressure systems. (In cases where the high-pressure main acts as a feeder along its course, a governor becomes necessary at such points.)

There has now to be considered the extent to which high initial pressure is available. In conjunction with the scheme just described, gasholders have ceased to be entirely depended upon for the purpose. Diagram No. 4 shows graphically the relationship between holder pressure and capacity in the case of the South Metropolitan Company's 45 million cubic feet.

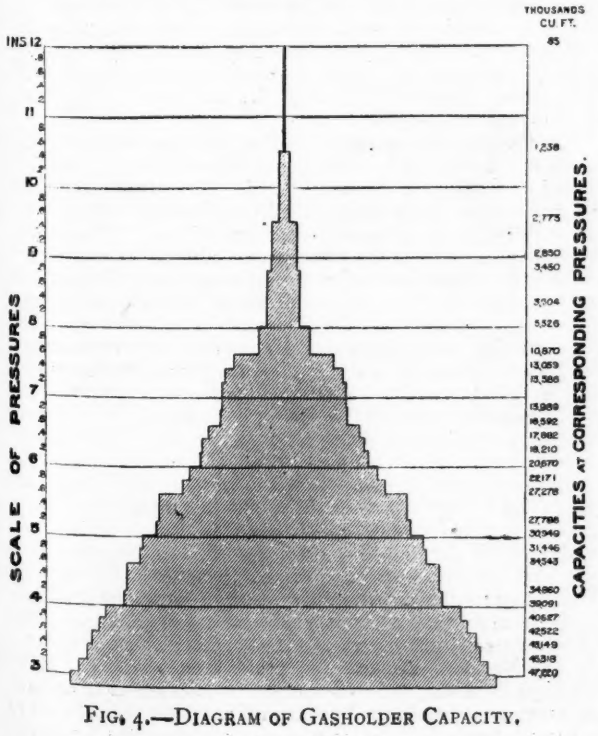


FIG. 4.—DIAGRAM OF GASHOLDER CAPACITY.

It does not need pointing out that when stocks are nearly at their lowest the demand is generally greatest. Moreover, in view of the enhanced lighting value of gas when consumed under some such arrangement as the Somzée-Greyson,* ideas of pressures at consumers' meters may yet be capable of three or fourfold expansion in the future.

Some two years ago, Mr. George Livesey suggested the use of high-speed centrifugal fans worked by gas-engines for the purpose of increasing initial pressures. Under his instructions, a fan was installed at Kennington, where the plan has been worked for the past two winters with every success. The type used is a special form of the Sturtevant exhauster. One of them (No. 7A) is used to supply gas from one of stations A to B, shown on Diagram No. 3—in this particular case from Kennington to Clapham. It is driven through belting by a single steam-engine having a cylinder 5 inches in diameter with 5-inch stroke. The entire cost of the plant, which stands in a space 8 ft. 6 in. square, was £135 fixed complete. It is estimated to handle upwards of 300,000 cubic feet of gas per hour.

A larger fan (No. 11A) supplies gas to the governor main inlet from the low-pressure lifts of the holders, and is driven by a 12-horse power (nominal) gas-engine. The cost of this plant, exclusive of connections, was £350, and it occupies a space measuring 22 ft. by 18 ft. The supply-main is 3 feet in diameter; and the connections into and out of the fan are 2 feet in diameter. The fan-spindle runs at about 1200 revolutions per minute; and not the slightest trouble or anxiety has arisen since it was first started.

It was possible, by means of the station meters and gasholder stocks, to measure accurately the duty of the apparatus under varying conditions of pressure; and the results are shown in the table, p. 1202.

It will be seen from the table that the mechanical efficiency of the fan must be very high—considerably beyond that of any positive form of exhauster. Its first cost compares equally favourably; and it has, besides, the enormous advantage that, in case of stoppage through any accident to the driving machinery, the full area of the gas passage is always maintained.

In conclusion, the author ventures to express the hope that the foregoing description of the distribution scheme adopted by the Company with which he is associated, and of the apparatus employed for its attainment, may prove serviceable.

* See *ante*, p. 969.

Table of Work Done by No. 11A Fan.

No. of Test.*	Gas Pressure on Main.† Inches of Water.			Gas Handled per Hour. Thousand Cubic Feet.	Engine Speed. Revolutions.
	Main Inlet.	Main Outlet.	Difference = Duty of Fan.		
1	6·3	8·4	2·1	1286‡	184
2	4·1	7·7	3·6	1023	182
3	3·5	8·0	4·5	932	..
4	2·9	8·4	5·5	839	..
5	2·5	8·0	5 5	712	..
6	2·8	8·0	5·2	699	..
7	−1·0	6 3	7 3	631	..
8	0·8	7·7	6·9	602	..
9	0·4	7·5	7·1	595	..
10	−0·5	5·5	6·0	537	190
11	0·9	7·8	6·9	472	..
12	1·4	8·8	7·4	425	192
13	3·2	10·6	7·4	397§	186

Work Done by Fan.—Supplying gas from holder outlet to governor main inlet. Average speed of fan, 1200 revolutions per minute; average gas consumption of engine, 500 cubic feet = at 1s. 6d. per 1000 feet, 9d. per hour.

* Each test is the record over one hour's run.

† The pressures given are not those on the connections in and out of the fan, but on the main-pipe before and after the bye-pass valve.

‡ Cost of gas for engine, 0·007d. per 1000 cubic feet.

§ Cost of gas for engine, 0·024d. per 1000 cubic feet.

Discussion.

Mr. J. D. Ashworth (Portsmouth) asked if this system were not rather risky where there was only one holder, as was often the case in small works. In large works, where there were two or three gasholders and several fans, it would be all right; but if there were a breakdown where there was only one holder, he feared it would be a rather risky problem. Another question was whether, as the holder lowered, the speed would not require to be excessive to make up the amount of pressure in the holder. He understood the idea was to give sufficient initial pressure, in spite of the lightness of the holder. The lightness was due to the design of the holder more than anything else, and mainly to the inner lifts going outside the columns, and not having the ordinary carriages on, or something of that sort.

Mr. Percy H. Fletcher (Evesham) said he understood the suggestion was that small mains should be used instead of laying large trunk mains; but what would be the result if the exhauster suddenly pulled up when the heaviest consumption was on?

Mr. W. King (Liverpool) said a good many years ago this subject came before them in Liverpool, inasmuch as a large connecting main between two works separated by several miles was found to be getting too small. They then used pumping machinery, which was still employed—and he believed it was adopted very generally at other works—to force the gas from one works to the other, in consequence of the comparatively low pressure of the holders. This was not done, however, so much in the way of pumping directly into the distributing mains, as to take the gas from one works to another, where it was put into a gasholder; and this became merely an accumulator. If the demand at the distant works was greater than the amount of gas sent to the exhausters, the gasholder began to descend to supply the vacancy. If, on the other hand, the gas which went to the distant works was more than the governors required, the gasholder began to rise, and acted as an accumulator. It was an interesting question; and if by the adoption of such a system an enlargement of main was avoided, it was evident it would be of very great advantage, not only in the saving of capital outlay in the extension of mains, but because it would avoid the nuisance to the public by tearing up large and important streets.

Mr. J. W. Helps (Croydon) said he had not found any necessity in his town for adopting such a method as was suggested; but he quite appreciated the great difficulties that sometimes did exist where the large holders had inner lifts which gave very light pressure. Having several holders at Croydon, they were able to work the higher lifts—to get the heavy holders full—by day, to give enough pressure at night, working out the light lifts during the day time. It did seem, however, that a difficult point in connection with the matter was the one which would arise in the event of the blower suddenly pulling up. They might at one time be supplying gas at 7 or 8 inches pressure, while the holder would only have some 3 or 4 inches; and though this might be sufficient to keep the lights from going out entirely, it would cause a deal of dissatisfaction to consumers, and no doubt numerous complaints would arise. Perhaps Mr. Carpenter could give them some further information on this point. He would also ask whether it was necessary to have the fans in duplicate. Considering the small amount of money they cost, he should have thought this advisable, because he noticed they must always work at a high speed; and high speed naturally meant a good deal of wear and tear, and some likelihood of a breakdown.

Mr. S. Meunier (Stockport) said at last year's meeting, when this subject cropped up, a suggestion was made that instead of forcing the gas through these mains by high pressure, and so increasing the probable loss by leakage, it might be possible to put the fan or exhauster at the far end of the district, and increase the pressure at that point. Since then, he had done something of the sort on a small scale, with an independent main between two of his works, to see what the result would be. He had certainly found a distinct improvement, inasmuch as he had not had the slightest difficulty in getting into the gasholder at the second station at least twice as much gas in the same period of time as he did before by simply forcing it. The thought struck him last year whether it would not be as well, or even better—taking into consideration the leakage likely to occur by increasing the pressure up to 12 inches—to follow the example set by electrical engineers, of having sub-stations fitted either with accumulators or rotary transformers. It appeared to him that the greater the pressure the more the leakage, though this, of course, depended upon the mains, and how they were laid. But he thought it was rather risky to increase the pressure too much; and he should like to hear Mr. Carpenter's views on the question of the establishment of a small sub-station somewhere where he could draw from the trunk main and distribute the gas through the district where it was wanted, and whether this would not answer the purpose equally well as forcing the gas direct from the station at high pressure.

Mr. Guyatt inquired if the sign prefixed to Nos. 7 and 10 in the table indicated a vacuum.

Mr. Carpenter said that was so.

Mr. Guyatt asked if there would be any difficulty with the holder under such circumstances.

The President, in closing the discussion remarked that he should like Mr. Carpenter to say whether he thought it necessary to duplicate the blowers. He had some seven or eight of them in operation in a cement works; and every now and then they went to pieces entirely—there was no question of repairing them. Therefore, where so much depended on them, and the outlay was so small, he should think it would be well to duplicate them. It was he who had raised the question last year with regard to exhausting through the mains, when he did not get what he considered a very convincing reply; and he would be glad if Mr. Carpenter would deal with it more thoroughly.

Mr. Carpenter, in reply, said he was not sure he had made his case quite as clear as he should desire; and he feared the diagram was not very legible. It was a scale diagram on the utility of gas-mains taken on an average day, midway between midsummer and midwinter. It brought out the point which the electricians suffered from greatly as well as themselves—the high peak, which meant that only during a portion of the 24 hours was the outlay on the mains productive. The problem was how to make them productive; and following upon this view, he thought they would succeed in doing so if they were to look more to the initial pressures than they had done. In order to bring this out more clearly, he had prepared the second diagram, which showed the pressures required to keep the mains equal. This was the essence of the paper—whether it was not better, instead of increasing the expenditure on mains by laying new ones, to make the mains more productive. Why should they spend so much capital on mains which they made so little use of, and distribute the gas with an initial pressure of only 3 inches? There was absolutely nothing in the suggestion of increased leakage through employing high pressure. A tremendous amount of gas was distributed in the Metropolis at high pressure. In the North of London, the great bulk of the gas was made at Beckton, and was sent up to London at an initial pressure of somewhere about 24 inches; but according to "Field's Analysis," the leakage was not excessive, because

they stood very well as regarded unaccounted-for gas. For many years he had experience of pressure mains of large size, up to 30 inches; the pressure being from 12 to 15 inches. The only escape they had had with them was due to the making of a big sewer in a very busy part of the district. Apart from this they had never had a leak on their high-pressure mains of about a mile long. With regard to the duplication of the fans, he did not consider it necessary, because they were not running continuously, but only at the hours of maximum load. There were conditions under which, when the holders were quite full, it might not be necessary to run them at all; and, generally speaking, they were only working for a few hours. Up to now they had had no trouble with them. He never had a hot bearing, or any difficulty at all. If the fans were running throughout the 24 hours, he should consider a duplication necessary. For instance, in the case of one works, where the gas was made at one station and sent down to be measured and stored half a mile away, in midwinter there was a great deal of trouble owing to back-pressure thrown on the mains, meters, and holders; and he was arranging to get rid of this next winter by putting down fans to deal with the whole make. The fans would draw the gas from the inlets of the meters, and force it through into the holders. In this case, they would be working throughout the 24 hours; and he should certainly think it essential to have duplicates. It was not the same as with an exhauster—that the apparatus stopped altogether. In case of an accident—which in his experience was very unlikely—one would simply suffer from a reduction in the pressure. With respect to the speed, there was nothing very remarkable about it. The large fan went at 1200 revolutions a minute; and if the straps were wide enough to transmit the horse power of the engine without having them too tight, there was no difficulty in running them continuously. Some few weeks ago, he had information about a plant in America running under something like identical conditions, which he understood had been working for many weeks on end without intermission. He wrote to America for information; but it had not yet come to hand. Therefore he could only say that the plant was in use for a similar purpose to that described, by the Consolidated Gas Company of New York. With respect to the question of the large holders of the South Metropolitan Gas Company, the scheme of high-pressure distribution did not depend on the weight of the holders. He suggested that the fans could be profitably utilized in two ways: First of all, by increasing the initial pressure at certain portions of the district—that there should be a high-pressure system and a low-pressure system, and for the high pressure the small fan should be used. The second point was that when the holders were low, uncupped, and the inner lifts only available, this afforded a ready means of providing whatever initial pressure was required. He had heard of cases of works which stopped on Sunday, but where it was found necessary to work for a portion of that day, at any rate, not because there was any shortness in the gas stock, but because it was locked up in holders which were not heavy enough to give the required pressure. With regard to the substitution of district stations, he would point out that his method required no extra cost. It was put down at the gasholder station; and when the man started the engine, he set the fan running. The journals were all provided with self-lubricating oilers; and, having once started, it ran as was required without any extra attention. It was all on land already available. If it were fitted in a cottage in an outlying part of the district, they would have to rent the cottage, and have a man in continual attendance there throughout the year. If the fans were put on the distributing station, perhaps they might get over all these extra charges. He would not say there might not be cases in which it would be advantageous to do as Mr. Meunier suggested; but certainly he thought the most economical plan was to do it from the distributing station.

Mr. Meunier asked whether Mr. Carpenter already had his high-pressure mains laid.

Mr. Carpenter said they were not originally laid as high-pressure mains; but they cut off the intermediate connections, and converted what was an ordinary low-pressure main into a high-pressure one.

Mr. Meunier asked if Mr. Carpenter would establish a sub-station, or lay a special feeding main, if one of the two had to be done.

Mr. Carpenter said if it were impracticable to do what he did—cut off the connection near the works, and supply them from the through governors—he should have no hesitation in adopting Mr. Meunier's suggestion.

WIND PRESSURE ON BUILDINGS AND OTHER STRUCTURES.

By J. O. V. Irminger, of Copenhagen.

In a general way, the pressure of the wind is expressed in the force exerted on square feet of surface; the surface in question being assumed to be vertical to the direction of the wind. This pressure is expressed as the normal pressure. If the surface acted upon is at an angle to the direction of the wind, various well-known formulæ may be employed, several of which have been independently verified. Table I. gives these well-known formulæ, where the pressure is calculated according to the angle, and where P is the normal pressure.

Many experiments have been made to verify these formulæ, and especially mentioned is Professor Langley, of America, who has devoted much time to the work. He employed a surface of 1 square foot turning on a radius of 30 feet. This surface could be fixed at any angle, and the pressure was measured by a spring. The apparatus had, however, drawbacks, as the air was seldom quite still, and the surface of the apparatus warped; but he found that with 5° the pressure on the surface was 0·15 of the normal pressure, with 10° = 0·30, and with 45° = 0·93.

The results coincide fairly well with the stated formulæ, but give a much higher value to the first $\sin^2 \infty$, often quoted in the technical handbooks. These high pressures at small angles were completely confirmed, which before the experiments of Professor Langley were a matter of speculation. Pressures on different forms of bodies were not included in Professor Langley's experiments.

Among other later experimenters, Professor Kernot, of Australia, must be mentioned. He employed for his experiments artificial wind, produced by the aid of a small propellor fixed in a wooden box 10 in. by 12 in.; and the pressure was exerted on small objects such as cubes, cylinders, &c., fixed in this box—the results being measured by a delicate spiral spring. He expressed his results in proportion to the pressure exerted on a vertical section of the object experimented on. Later the writer will return to these researches.

All these experiments give the sum of the total pressures, but do not seek to analyze this sum—for instance, the tension of the air on the different portions of the planes and bodies. Generally speaking, the subject has not been a favourite one, and the data on the matter have been of a meagre kind; at any rate, it was only the *pressure on the wind side*, especially at small angles, that was experimented on—the part played by suction being little known.

Herr H. C. Vogt, of Copenhagen, demonstrated some years ago, before Professor Langley's experiments were published, in several *brochures* that the pressure on a plane at a small angle was very great; and he discovered the reason to be that on the lee side of the plane there existed a strong tendency to a vacuum, and that this partial vacuum or attenuation of the air was equal to 90 to 95 per cent. of the power exerted. Although his arguments were so convincing, his theory found little support; and, in fact, there were many who were positively sceptical.

As this question interested the writer in no small degree, he determined to carry the experiments further; and as it was soon evident that the results of importance were within reach, the research was continued with specially constructed apparatus. It is the writer's hope that a recapitulation of these results may not be without interest to those who have not had the opportunity of previously studying the subject.

To study the pressures and vacuum exerted on a plane, such a plane was constructed of tin having a flat surface, but hollow. The interior or hollow room was placed in connection with a delicate pressure-gauge, and on the flat surface a little hole was bored so that the outer surface with the hole was likewise in connection with the gauge. By presenting the hole to an air current, it was possible to establish the presence of a pressure if the aperture was in the direction of the wind, and a vacuum when the aperture was in the contrary direction; but at the same time it was evident that no reliable results were obtainable, as the strength of the wind was so variable.

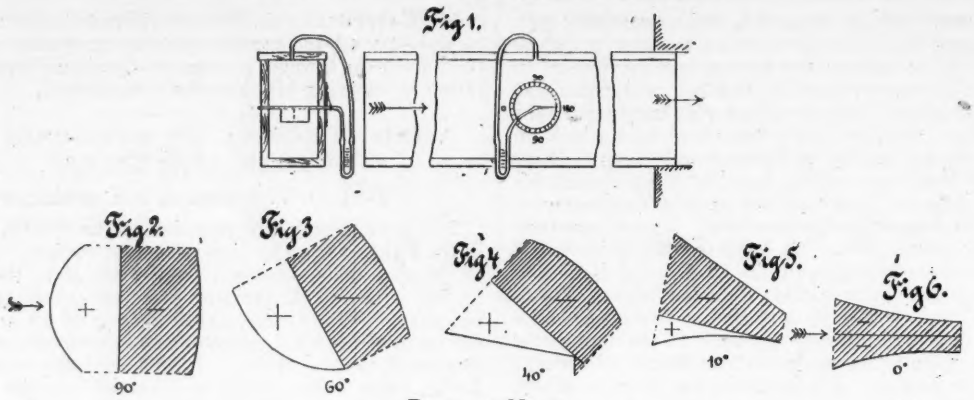


DIAGRAM No. 1.

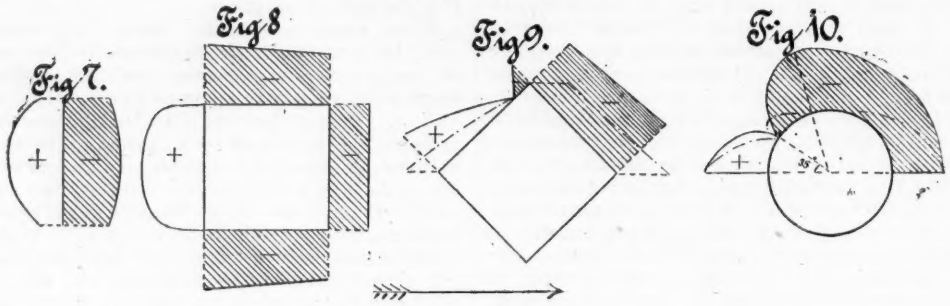


DIAGRAM No. 2.

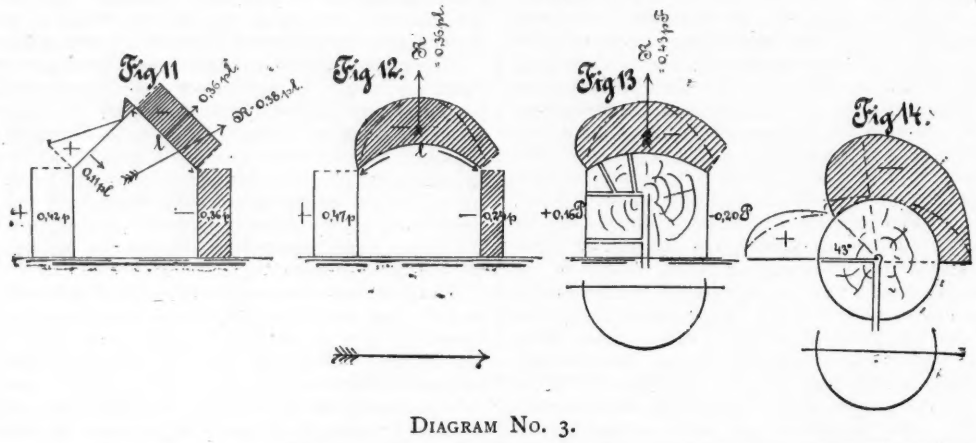


DIAGRAM No. 3.

To arrive at definite results, it was therefore necessary to create artificial draught; and this was done by employing a chimney-shaft 100 feet high, which was in connection with the retort-benches, and which gave about $\frac{3}{4}$-inch vacuum at the base. In calm weather, the suction was constant, which was first carefully ascertained. In this manner it was possible to experiment with a powerful draught; but the bodies experimented on were naturally of limited dimensions. At the same time it is a well-known fact that these laws apply equally to small as well as to larger bodies.

The apparatus used, which is shown on Diagram No. 1 (fig. 1), consisted of a smooth wooden box 9 inches by $4\frac{1}{2}$ inches, fixed at the base of the chimney. In this box the bodies to be experimented upon were placed—for instance, a flat plane. This was of tin, hollow, and perforated with three holes—two at the outer edges and one in the centre. This plane revolves on a central axis, likewise hollow, closed at one end, but in connection with the internal hollow of the plane. The open end was connected to a pressure-gauge. It was now only necessary to find a zero, or the atmosphere's tension; and for this purpose a hole was made in the box, exactly over the body to be experimented on. In the hole a tube was fixed, projecting not quite through the lid of the box, and connected with the second arm of the pressure-gauge. By these means the variation of tension in the box itself and the interior of the hollow plane were ascertainable.

To find the tension in various positions, an indicator and scale was attached to the central axis outside the box. The draught to which the apparatus was to be subjected could be regulated by a valve, attached to the end of the box, the position of this valve being constant under each separate experiment. The normal pressure—*i.e.*, the pressure on a plane at right angles to the direction of the wind—was ascertained by turning the plane with the holes towards the wind, and observing the pressure, and then turning the plane 180°, so that the holes were on the lee side. The resultant sum of this ascertained pressure and vacuum was considered the normal pressure.

It was now apparent that when the pressure—taking, for instance, a single experiment—is about 0·45 inch of water on the front side, the suction of vacuum at the back is 0·62 inch, and the normal pressure 1·07 inches, which represents 5·8 lbs. per square foot, or equal to a calculated wind speed of 50 feet per second. There were, as previously mentioned, three holes in the plane. These were experimented on, when the average pressure was ascertained. The holes were now successively shut by sticking-plaster.

As the result of many trials, it was evident that the suction power or vacuum was equal to 57 per cent. of the total pressure or power exerted; but for shorter planes, with air on all four sides, 45 per cent., which is demonstrated on Diagram No. 1 (fig. 2), where the pressures are shown by the heights of the water-column in the gauge.

If experiments be now made on the plane at varying angles—say, 0°, 5°, 10°, &c. (figs. 3-6)—at 0° suction is evident over the whole surface of the plane. At 5°, on the weather side *nil*; on the lee side, suction is greatest nearest the edge towards the wind. At an angle of 10°,

TABLE I.

Degrees.	$Fa = P \sin^2 a$.	Lossl. $Fa = P \sin a$.	Hutton. $Fa = P \sin a \, 1{\cdot}84 \cos a$.	Duchemin. $Fa = p\frac{2 \sin a}{1 + \sin^2 a}$.	Rayleigh and Gerlach. $Pa = p\frac{(4+\pi)\sin a}{4 + \pi \sin a}$.	Langley. $\frac{Fa}{P}$.	Writer's Experiments. Long Planes. $\frac{Fa}{P}$.	Writer's Experiments. Long Planes. Suction.	Writer's Experiments. Short Planes. $\frac{Fa}{P}$.	Writer's Experiments. Short Planes. Suction.
								Per Cent.		Per Cent.
5	0·008	0·087	0·131	0·17	0·146	0·15	0·23	100	0·12	100
10	0·030	0·174	0·241	0·34	0·273	0·30	0·45	87	0·26	100
15	0·057	0·259	0·350	0·48	0·384	0·46	0·47	85	0·41	100
20	0·117	0·342	0·457	0·61	0·481	0·60	0·48	83	0·52	94
30	0·250	0·500	0·663	0·80	0·641	0·78	0·60	75	0·65	83
40	0·413	0·643	0·834	0·91	0·763	0·89	0·75	67	0·74	74
50	0·587	0·766	0·952	..	0·854	..	0·84	65	0·82	66
60	0·750	0·866	1·012	..	0·920	..	0·90	63	0·90	56
70	0·883	0·940	1·023	..	0·965	..	0·95	62	0·95	51
80	0·970	0·985	1·011	..	0·991	..	0·98	59	0·93	47
90	1·000	1·000	1·000	..	1·000	..	1·00	57	1·00	45

it is ascertained that the pressure on the wind side is greatest first at the *fore-edge*, while the suction on the lee side increases.

The writer found on those planes filling the width of the box—viz., extremely *long* planes, with 5° complete suction—at 10°, 87 per cent., and at 90° 57 per cent. suction. With *short* planes, at 15° complete suction, at 20° 94 per cent., at 90° 45 per cent. One can thus ascertain the pressure on the planes by adding the observed water-column heights, and the given pressure in proportion to the normal pressure. The results are given in the above table.

It is thus apparent that the ascertained results compare well with Langley's experiments, and equally well with the majority of the previously ascertained formulæ, especially with Rayleigh's and Gerlach's. Professor Cederblom, of Stockholm, has recently conducted some experiments with pressures on planes turned towards the wind, inasmuch as he employed a very finely graduated and sensitive pressure-gauge connected with the holes in the plane. He used natural wind, and ascertained exactly the same pressure and suction as tabulated previously. Professor La Cour, in Denmark, has likewise recently conducted some exhaustive experiments on windmills, and has verified the tabulated results. The writer has reason to believe that the method of his experiments is correct, and that the size of the planes experimented on plays no appreciable part. What, however, is very evident is the part played by *suction*, especially on planes at small angles.

Experiments were further carried out on various elements, hollow and constructed of tin; but later, for the sake of lightness, of wood bored out—for instance, a sphere, as shown in fig. 14 on Diagram No. 3 (sphere). The results are shown in Table II., where the pressure on the wind's direction is expressed by d and p. It is thus ascertainable what power is due to pressure and what to vacuum.

The writer desires to shortly sum up the results of the most characteristic experiments, and draws attention to diagram No. 2, where the amount of pressure and suction is expressed in measured water-column heights. The full lines express the normal pressure on the surface, the dotted lines the pressure in the direction of the wind. These are found by resolving the pressure into two powers—a vertical (not taken into consideration) and a horizontal one. Taking, for instance, a *long prism* (fig. 8 on Diagram No. 2), pressure is found on the front, and suction on the three remaining sides. The pressure is 95 per cent. of the pressure in a plane of the size of the cross-section of this body; the suction equals 43 per cent. If the *point* of the prism be presented towards the wind, the pressure only equals 0·79 per cent. (fig. 9).

Cylinder.—This cylinder (fig. 10) presents some extraordinary conditions, inasmuch as there is pressure up to 35°, the rest being suction—the maximum being 70°. Resolving likewise the powers in the wind's direction, the dotted lines are obtained, which show the pressures and suction; the total pressure being 0·57, suction 72. Experimenting on a *prism of rhomboidal form*, the total pressure is 0·25, of which suction is represented by 82. This three-sided prism is shown in three different positions. (See Table II.)

On the sphere (Diagram No. 3, fig. 14) the pressure is found by turning on a lathe a wooden ball, and boring channels for connecting it to the pressure-gauge. It is then revolved gradually on its axis, and similar effects are found to those on a cylinder—viz., pressure up to 43°; the balance being suction. As the conditions of pressure are alike at the same distance from the axis, one can estimate the volume of the body, depicted by the dotted lines which show the horizontal powers; and one finds the total pressure to be 0·31 of the pressure on the great circle.

Under the same conditions, experiments were made on *short elements*, such as dice, cylinders, cones, pyramids, &c.; the results being given in Table II.:—

TABLE II.

Long Bodies.		p = pressure on Square Unit.	Pressure per cent. Wind Side.	Suction per cent. Lee Side.	Short Bodies.		p = pressure on Square Unit.	Pressure per cent. Wind Side.	Suction per cent. Lee Side.
—					—				
⟶		$1{\cdot}00\,p\,d$	45	55	⟶		$0{\cdot}31\,p\frac{\pi d^2}{4}$	23	77
Prism		$0{\cdot}95\,p\,d$	57	43			$0{\cdot}08\,p\frac{\pi d^2}{4}$	7	93
,,		$0{\cdot}79\,p\,d$	21	79	Cube		$0{\cdot}80\,p\,d^2$	78	22
Cylinder		$0{\cdot}57\,p\,d$	28	72	,,		$0{\cdot}66\,p\,d^2$	45	55
		$0{\cdot}25\,p\,d$	18	82	Cylinder		$0{\cdot}47\,p\,d^2$	50	50
		$0{\cdot}59\,p\,d$	58	42	Pyramid		$0{\cdot}78\,p\frac{d^2}{2}$	63	37
		$0{\cdot}71\,p\,d$	63	37	,,		$0{\cdot}55\,p\frac{d^2}{2}$	45	55
		$0{\cdot}42\,p\,d$	14	86	Cone		$0{\cdot}38\,p\frac{d^2}{2}$	50	50

The results of experiments on the cylinder give the smaller number, 0·47; on a pointed element only 0·08, of which suction = 93 per cent.

For comparison's sake, it may be noted that—

Professor Kernot found—		The writer—	
For cubes.	0·90	For cubes.	0·80
,, cylinders and cones	0·50	,, cylinders . . .	0·47
		,, cones.	0·38
,, cones.	0·36	,, ,, ...	0·31

It is evident that the results agree fairly well, especially when it is taken into consideration that two distinct methods of experimenting were employed.

These sucking actions on flat surfaces parallel with the direction of the wind are remarkable; but experiments easily establish the facts. For instance, by taking two pieces of paper, holding them parallel to each other, and blowing between them, they are drawn together.

On spheres, the sucking action was evident on all the sides the wind passed. It was thus easy to explain why a light ball could be held suspended in a vertical air stream, because the stream was creating a vacuum around the ball. An umbrella ascends vertically when released in a storm, &c. By the same reasoning, the trick of blowing an egg from one cup to another is explained.

It is now of interest to obtain the result of these conditions applied to buildings; and the writer has therefore conducted some experiments with models. (See Diagram No. 3.) The one is a model of a house with an ordinary roof, the other with a semicircular roof. With the first (fig. 11), the results were precisely the same as those obtained from a prism—*i.e.*, pressure on the wind side, diminishing in an upward direction, and suction on the lee side. Adding together these powers, a result is found

in an inclined upward direction per square unit = 0·38 × wind's normal pressure. On the other building (fig. 12), the result was the same as with the cylinder—*i.e.*, a suction on the whole of the roof surface, and a resultant directly upwards per square unit = 0·36 × wind's normal pressure.

Further, experiments were made on a round building, with a curved roof similar to a gasholder (fig. 13). Channels for connection with a pressure-gauge were bored in the model, as shown on the drawing; the result being a pressure on the side = 0·36 × wind's normal pressure on the cross section, but on the crown a suction in a vertical direction per square unit = 0·43 × normal pressure. On the sides the distribution of pressure is the same as on the sides of the cylinder, and on the roof or crown the same as on the upper roof of the sphere, previously referred to. The roof of such buildings has thus a tendency to be lifted into the air in a storm when the weight is insufficient, or the roof is insufficiently tied, to resist this tendency. The experiment on a gasholder can be amplified by suspending a little gasholder model at one end of a lever arm, and submerging the same in a basis of water, so that only the roof of the holder is above the water. If one blows on the roof with a bellows, the holder will lift itself from the water, and the pressure in the same will be reduced.

It is of further interest to inquire if these experiments have direct relations to what passes on a larger scale, when buildings are subjected to a heavy storm. It may be remarked that one often hears of roofs being lifted and carried away by storms. It is not of frequent occurrence in Europe; and if such an event does happen, it is usually with light roofs. It is likewise established that it is generally the lee side which suffers, inasmuch as it is *sucked* away. The writer has made observations on roofs during a storm, by boring some small holes in the slates, which holes have been put in connection with a pressure-gauge; and the pressure and suction conditions established by experiments were clearly present, varying with the wind's strength.

With a gasholder, the experiment was likewise made during a storm to connect the outlet-pipe with a self-registering pressure-gauge. The holder contained 2 million cubic feet, and was 170 feet in diameter and 90 feet high. During an exceptionally heavy storm, on the 30th of March, 1897, the pressure in the holder sank from 6·25 to 5·83 inches, or 0·42 inch; varying continually with the strength of the wind. The holder was quite full, and gave in calm weather 6·25 inches pressure. This 0·42 inch is equal to a lifting force of 2·1 lbs. per square foot, or 44,000 lbs. on the total surface of the roof. Applying the formulæ found by experiments, 2·1 = 0·43, or p = 4·9 lbs. per square foot, which represents the wind's most powerful impact on the roof of the holder. The pressure on the side of the holder was 0·36 × 4·9 × 15,000 = 26,600 lbs., of which 11,800 lbs. was the pressure on the wind side and 14,800 lbs. suction on the lee side.

Referring to information obtained from the Meteorological Institute in Copenhagen, where the wind is measured with a self-registering pressure-gauge, the wind varied on the occasion named from 29 to 70 feet per second. This pressure appears to be very low; but, in reality, the wind pressure on a large surface is never so great as estimated, on account of the irregularity of the wind's speed.

The variation has been especially studied by Professors Langley and Marvin, of America, and it has been demonstrated that, even on high places lying unsheltered, the wind varied incessantly. Professor Langley noted variations of from 9 to 36 miles per hour, and ascertained that, taking the average of the maximum and minimum variations, the speed varied 10 miles each 10 seconds. The speed would suddenly vary from 40 miles an hour to 0; but there were innumerable variations. Professor Marvin discovered similar variations, and at the Copenhagen Meteorological Institute (where the wind speed is measured by current passing over an open vertical pipe, in which the contained liquid is raised by the rarefaction or suction caused by passage of the wind) results of a like nature were observable.

Sir J. Wolfe Barry, the Engineer of the Tower Bridge, read a paper last year before the British Association,* in which he explained that, after the destruction of the Tay Bridge, the Board of Trade issued instructions to the effect that all future calculations were to be made on a basis of a pressure of 56 lbs. per square foot, instead of the 40 lbs. as previously calculated; and he further remarked:

> I have been able to carry experiments further at the Tower Bridge by observing the pressure on the surface of the bascules of the bridge, as evidenced by the power exerted by the actuating engines. In this case we have a wind-gauge of some 5000 feet in area; and it has been shown that, while small anemometers placed on the fixed part of the bridge register from 6 lbs. to 9 lbs. per square foot, the wind pressure on the bascules is only from about 1 lb. to 1½ lbs. per square foot. It is difficult to imagine the amount of money which has been wasted in unnecessary provision against wind strains of 56 lbs. on large areas, in consequence of this hurried generalization of insufficient data. I know something of what the provision for 56 lbs. on the square foot for wind cost at the Tower Bridge, and I do not wish to mention it. But if the public had been told that the dictum of experts, arrived at however hastily in 1880, was to be set aside in the construction of that bridge, all confidence would have been destroyed in it beforehand, and I suppose no Committee of Parliament would have passed the Act.

Here the pressure per square foot is even less than that ascertained by the writer during a storm—viz., 4·9 lbs. per square foot—perhaps on account of the area of the gasholder being three times as large.

The writer once, under a storm, tied with a thin cord a large gasholder, 120 feet in diameter, fast to a column on the wind side. The cord held for half-an-hour, and eventually broke. It was confirmed, by testing the breaking strength of the cord, that the wind pressure was only 3 lbs. per foot. A communication on this subject was sent to the "JOURNAL OF GAS LIGHTING" for May 4, 1897.

If one really wishes to become acquainted with the force of the wind, America is the place to visit. Mr. J. Baier, an American Engineer, has published the results of some inquiries on wind pressures in the "Proceedings" of the American Society of Civil Engineers for January, 1897. These statistics are voluminous, and are accompanied by many photographs which depict ruined structures which have the appearance of having been submitted to the effects of fearful earthquakes. The writer will dwell shortly on several of the items which are of special interest, and which are closely allied to the subject under discussion.

A tornado demolished, in the course of half-an-hour, something like 7263 buildings, of which number 321 were totally razed to the ground. At the same time the new large St. Louis iron railway bridge was ruined, 252 lives were sacrificed, and the monetary loss amounted to £3,000,000 sterling. The buildings for the major part were built of iron and stone. To quote an instance of the storm's severity, it can be mentioned that the railway bridge was ruined by the wind lifting a portion of the track, weighing 280 tons, quite away, at the same time demolishing the brickwork. Enormous steel beams, weighing 13,000 lbs., were flung 120 feet away. The railing of the bridge flew 1300 feet from its original position; and it was proved that the wind exerted a lifting force on the roadway of the bridge of 43 lbs. per square foot. The loosened portions of the bridge were hurled through the air similar to projectiles; one wood plank being thrust through an iron plate $\frac{5}{16}$ inch thick. A large corn elevator, of wood, weighing 3500 tons, was removed 19 feet and crushed. Another even heavier elevator was pushed 11 inches to one side, but again blown back. This is enough to show the appalling power that had been raging.

The storm exerted its force mostly on the upper storeys, where the roofs were lifted off and blown away, with the consequence that the walls collapsed. It was estimated that the wind force equalled 120 miles per hour—about double the speed known in Europe, and equal to four times the force. The upper storey of the Meteorological Institute was blown away, and many of the instruments followed suit; but, with true American energy, the observations were continued as well as possible under the existing conditions on the lower floors. Mr. Baier found that, on estimating the stability of the structures, the force exerted on and in the destruction of the St. Louis bridge must have been 60 lbs. on the square foot, and the power which removed the corn elevators 40 lbs. on the square foot. Such a hurricane simply razes all and everything in its path, but is fortunately not known in Europe; and if we assume that the forces mentioned by Mr. Baier are correct, it cannot be wondered at that those estimated in Europe are considerably less violent.

Mr. Baier has further inquired into the reasons for these tremendous effects of storm, and is convinced that a great portion of the destruction is due to the constant variation in the speed and strength of the wind, by which great differences in pressures are established in the interior and

* See "JOURNAL," Vol. LXXII., p. 589.

exterior of buildings, which pressures have no time for adjusting themselves in a natural manner, but break through windows and walls, seeking equilibrium by the shortest way possible. A considerable portion of the damage is likewise due to the previously explained *suction* on the lee side of buildings and structures. Mr. Baier goes deeply into these matters; and the results have been published in America. He mentions that unexpected results have been arrived at, especially regarding the powers of suction, which may thus be looked upon as a known phenomenon. When the wind has a speed of 90 miles and a variation of 120 to 160 miles, it will, according to experiments, when it rushes across a building, exert a lifting force of 20 lbs. to 40 lbs. per square foot, without giving the pressure time to adjust itself. Finally, Mr. Baier says: "The results of these experiments show that the wind acts in a direction quite different from that generally assumed, and usually provided for in designing bridges, roofs, and buildings." The evidence of St. Louis confirms this conclusion.

One may thus assume that the experiments on the small models have been verified by Nature herself, and that calculations of the wind's force must be made on a different basis from that hitherto taken, inasmuch as, besides the horizontal effects, the upward force must be taken into consideration, the power of which can equal half the power of the wind's normal pressure.

Discussion.

The PRESIDENT (who read the paper) said they were all greatly indebted to Mr. Irminger for his original paper. He had come a long way to present it to them. There was a theory that a man was not a prophet in his own country; but he could tell the members that in matters of this description Mr. Irminger was a prophet in his own country. He had studied wind pressures for many years. He had made many experiments; and what he arrived at concerning gasholders was most noteworthy, and it would show them the methodical way in which he had conducted his experiments. They were simple, and they could themselves verify them with a little trouble. He invited discussion.

Mr. G. E. STEVENSON (Manchester) said he had the very greatest pleasure in listening to this paper; and he felt gratified that Mr. Irminger had been so ready to become a useful and ornamental member of the Institution, and that he had given them a paper at the very first meeting he had attended. He had the honour to propose Mr. Irminger as a member last year. Such a paper as had been read, they had not had for many years; but it was a class of communication that was the very thing they wanted. They were a body, not only of gas makers, but of civil engineers to a large extent; and it was very desirable, he thought, that the higher elements of the engineering sciences should not be forgotten in their meetings, and should receive the attention they had received in this paper. The paper was most interesting, showing how very easy it was for them to be for long periods under mistaken ideas as to the forces and effects of natural phenomena. As Mr. Irminger had suggested, wind pressures had been looked at from the point of view of preconceived ideas. Except when great catastrophes had drawn the attention of engineers to them, little had been done by investigation to prove whether established ideas were correct or otherwise. As to the form of roofs, for instance, the idea that a gable-ended roof should be a strong one for resisting pressure seemed, in the light of Mr. Irminger's investigations, and of others, to be ridiculous now. And after all the practice, based more on experience than on scientific study, seemed to show them this, when they thought of it. In many countries, where they had tornadoes, the roofs were flat; and they were protected by heavy parapets, in such a manner that the wind could not get under them. There was one matter which he was not quite sure about himself in Mr. Irminger's figures and statements; and he should be very glad to have this quite cleared up. When Mr. Irminger stated that so much percentage of the total pressure was pressure, and so much was vacuum, did he mean the actual wind pressure? If the anemometer or wind-gauge could show correctly what the wind pressure was, then it was important to provide for upward tendency. The investigations of Mr. Irminger would be found to be extremely useful; and he wished to express his appreciation of the paper in every sense.

Mr. W. H. Y. WEBBER (London) said he wished to contribute his meed of praise to Mr. Irminger for his most admirable paper, which he thought focussed new information in very convenient form. The way the wind acted upon structures was the point of the paper, rather than the pressure of the wind; and it was to Mr. Irminger's credit that he had succeeded in making it clear that the action of the wind, whatever might be its value in weight, or whatever might be its measurable value on structures, was different to what had been generally believed. It was scarcely necessary for him to remark that preconceived ideas were the enemy of all truth and progress; but one of the things human nature was very prone to was to look on matters in the light of preconceived ideas. Some years ago, when he looked into this subject, he was amazed. Applying the same rule to the formulæ they had, the wonder was how the structures stood. He came to the conclusion that there was something wrong. He thought there were other forces acting in ways that were not clearly understood; and that the forces they had supposed they understood did not act in the way they thought they did—especially in the case of gasholders, which they were most interested in. He arrived at the conclusion that the great thing to do with a gasholder was to hold it down, and not so much to hold it up. His observations and experiences in the matter certainly led him to the conclusion that the safety of gasholders depended far less on the propping of them up as on giving them some sort of holding down. This he believed was the key of safe construction against the pressure of wind—that it was largely a question of holding down. He was confirmed in this view by some observations he made two years ago. He was down in the country; and a friend of his had recently put up at the top of the hill a water reservoir, which he covered with corrugated iron. The top of the reservoir was 8 feet above the surrounding soil; and it was made, in fact, to arrest the eye or catch the wind as little as possible. Grassed slopes led up to it; and the whole thing was almost buried. The projection of the corrugated iron beyond the wall was only a matter of an inch; and there were no means for wind to get under it. But there came a gale of wind; and the whole of roof was carefully lifted off and deposited in the adjoining field. What destroyed the thing was lifting, and not wind pressure at all. His friend said it went like a card would be shied. It certainly did not occur to him at the time to inquire whether his friend had fastened it down; but he did inquire afterwards, and, as a matter of fact, he, not being an engineer, had forgotten to fasten it down. The thing was so snug that there was no reason why the wind should interfere with it. The result was that it was destroyed by this action. He certainly did think they must remember the observation of the American engineer, that, when the wind was blowing very hard, there was a tremendous amount of oscillation going on. The wind did not blow with the same pressure one half-minute with another. He thought that the civil engineering profession generally was indebted to Mr. Irminger for the careful, conscientious, and luminous way he had put forward this question.

Mr. J. W. HELPS (Croydon) said he should like to give one experience which came to his notice a short time back. In February last, there was a storm of wind; and one of his workmen was telling him something which happened to the roofs of two houses next to that in which he lived. The roofs were lifted off their supports, and deposited in the garden. He was inclined to laugh at him; and he did not think the roofs could sail in the air. He, looking only at the pressure side of the question, thought they would be pushed down, and that part of the walls would have gone down too. He also thought the manner in which this question had been put before them had enabled them to understand many things they did not understand before. It often puzzled him how the first slate came off a roof. If what Mr. Irminger stated was true, the upward sucking action lifted off the first slate. With regard to wind pressure on gasholders, he thought any engineer who had fixed an ordinary self-registering gauge, and had noticed it in a heavy gale, would appreciate what Mr. Irminger had said—that the pressure on the gasholder varied from 6½ to 5⅛ inches. During the gale he had mentioned, he noticed there was a distinct variation of from 3-10ths to 4-10ths during the night. He again thanked Mr. Irminger for his paper; and he hoped they could have a few more like it in the future.

The PRESIDENT said some of them sailed a great deal. When a boat went to windward, there was little pressure on the mainsail at the mast. But the paper which had been read elucidated what made the boat go forward—they were getting behind the sail a vacuum. When he translated the paper, he could not help laughing, because he thought some of his good friends who had telescopic gasholders might one day find all the top part sailing into their neighbours' gardens.

Mr. IRMINGER, in reply, heartily thanked Mr. Stevenson, Mr. Webber, and Mr. Helps for their appreciation of his paper. With regard to gasholders, he would only say there was also a lifting power which it was necessary should have some support.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1231.)

THE Stock Markets were in a somewhat disturbed state last week. This was owing to matters which ought not to have had a depressing effect all round; but nevertheless the downward tendency seemed to extend. Prices all round, with scarcely an exception, show a marked falling off. The Money Market, too, was pretty stiff; and this helped to keep things down. In the Gas Market, movements were somewhat irregular; and the variations in quotation are a rather chequered list of ups and downs. But there are more increases than decreases; and they are considerably larger in degree. Business at the reopening after the holiday was animated, and gave fair promise of an active week; but it quickly fell calm, and dealings became very tame and quiet. In Gaslights, the ordinary stock began briskly, though prices were not good; but it soon grew weaker and quiet. On Tuesday, it touched 116½; but on Saturday it changed hands at 114⅜, with a drop of a point in the quotation. The secured issues were also much quieter; and they did not look like rising. South Metropolitan, which had been hanging fire some time, had to retreat a point; business on Saturday being marked at 139½. Commercials were more animated; and the new stock jumped up five points. Business in the Suburban and Provincial group was of the usual quiet type; and the only move was a rise in Brentford. In the Continental Companies, transactions were only limited; but the tone was good. Union had a nice advance; and Imperial also rose on a more moderate scale. There was no feature of interest among the rest, beyond a slight fall in Cape Town and a recovery in San Paulo. In Water, business was rather more animated, especially in Southwark ordinary, which rose freely. Grand Junction also was higher.

The daily operations were: Gas stocks opened rather active on Tuesday; and the prices marked were pretty good. Brentford new and Continental Union rose 2 each. In Water, Southwark ordinary advanced 3. Wednesday was quieter; but the tendency was still favourable. Imperial improved 2; and San Paulo ¼. Thursday showed a shade more activity, and Commercial new improved 5; but South Metropolitan fell 1. Friday was extremely inactive; and movements were irregular. Union rose 2; but Gaslight ordinary fell 1, and Cape Town ½. On Saturday, variations were confined to the Water Companies; Southwark advancing 2, and Grand Junction 1.

ELECTRIC LIGHTING MEMORANDA.

Professor Hughes the Discoverer of Wireless Telegraphy—The Discouragement of Discoverers—The Lesson of Galileo—The Work of Tesla.

A STRIKING illustration of the difficulty of assigning priority for new discoveries to particular claimants, has arisen in respect of the electric waves and their operation in what is known as wireless telegraphy. It now appears that Professor D. E. Hughes, the inventor of the microphone and the induction balance, not to mention other important and useful electrical appliances, knew all about the action at a distance of electricity upon a microphonic coherer so long ago as 1879. Mr. J. J. Fahie is writing a book upon Wireless Telegraphy; and he applied to Sir William Crookes for information, He learnt in reply that Professor Hughes was the man to apply to, inasmuch as Sir W. Crookes and others had many years ago seen Professor Hughes signal from one part of a house to another without wires. It seems a great pity that some account of these experiments was not published at the time, as the world might have benefited from the discovery earlier. As it is, Marconi's work must not be depreciated by the circumstance that Professor Hughes was before him with experiments which were not followed up to any practical result. The story now told is that, while working in 1879 upon his induction balance and microphone, Professor Hughes found that the primary coil of the balance under certain conditions gave out "extra currents," which affected the surrounding space, and were capable of acting upon any microphonic joint within their sphere of influence. These extra currents, or invisible electric waves, were evidently capable of permeating to great distances, even through brick walls or other material obstacles.

Professor Hughes actually showed sundry people the action of electricity at a distance; and he used to walk up and down Great Portland Street with the receiver in his hand and the telephone to his ear, in order to ascertain how far away he could hear the signals being made inside his house in this thoroughfare. He writes: "At Mr. A. Stroh's telegraph instrument manufactory, Mr. Stroh and myself could hear perfectly the currents transmitted from the third story to the basement; but I could not detect clear signals at my residence about a mile distant. The innumerable gas and water pipes intervening seemed to absorb or weaken too much the feeble transmitted extra currents from a small coil." Unfortunately for Professor Hughes, the fact of the existence of such extra currents as he was dealing with was at the period unknown to science. Their possibility was disclosed, or enshrouded, in Maxwellian equations; but Professor Hertz had not then demonstrated, as he did ten years later, the fact that these etheric waves existed and possessed some properties identical with those of ordinary light. The consequence is graphically described by Professor Hughes; and the lesson is one for all discoverers to take to heart. The Honorary Secretary of the Royal Society (Professor G. Stokes) was one of the spectators of the experiments, which at first astonished him; but after three hours of it, he declared that he could see nothing in them that could not be explained by known electro-magnetic induction. He therefore could not accept Professor Hughes's reference of the phenomenon to unknown forms of electrical waves. This declaration so discouraged Hughes that he refused to write a paper or say anything more about the matter until he was better prepared to demonstrate the existence of the waves; and he accordingly went on experimenting until Hertz came along and cleared away the mystery of the phenomena. Professor Hughes then thought it was too late to bring forward his previous experiments; and he was forced to see others make his experiments over again.

All this is of a piece with the history of discovery and invention since the world began. The high priests of the existing dispensation cannot be brought to acknowledge that they do not know everything; and the daring neophyte who ventures to begin where they have stopped, is usually "sat upon." This discouraging procedure may be held as containing a partial explanation of the reason why it is many a non-scientific and "self-taught" innovator occasionally succeeds in doing something which the knowing ones have esteemed impossible. He is not troubled with their burden of knowledge. He is happily ignorant of the difficulties which bring them to a standstill; and, accordingly, he sometimes blunders into a way through the obstacles which others would never have thought of. Obviously, however, it is not the knowledge which is the hindrance here, but the bad effect of its possession upon the human spirit. Human nature being what it is, the treatment that was meted out to Galileo is certain to be repeated time and again to the end of the world. The only remedy is for those who think they are on the path of progress to disregard the criticism of the elders and the outsiders, and to push on until they arrive at their goal.

It is some time since anything has been heard of Tesla's work. The attention that the scientific and practical world is deservedly bestowing upon the triumphs of wireless telegraphy, should not prevent students from following with equal interest the researches of the daring Slavo-American electrician. Tesla's labours are mostly in the realm of electric lighting, which is another reason why they should be observed with care. The current issue of the "Electrical Review" contains a report of some experiments conducted in Tesla's laboratory with currents of high potential and high frequency. In one of these the operator's body is charged to a high potential by means of his holding a coil responsive to the waves transmitted to it from a distant oscillator. In his other hand, he waves a long glass vacuum tube which glows with an illuminating power of 1500 candles. Again, a disconnected vacuum bulb is shown held in the operator's hand, and developing an equal amount of light without any apparent cause. It is difficult to follow the *technique* of Tesla's work. His performances appear to begin with a so-called "oscillator," by which he produces discharges of extremely high potential and great frequency. He is even reported to be almost afraid to work some of his apparatus, lest the atmosphere should be set on fire and the universe drowned in a flood of nitric acid resulting from the combustion of the nitrogen. It is asked how he can go on with his experiments in the face of such a risk, if he seriously believes in it. Probably he does not believe anything of the kind—knowing that, as Sir W. Crookes has demonstrated, the flame of nitrogen is not hot enough to propagate itself. The curious thing is that these tremendous electrical effects are producible by a current which the human body is capable of transmitting without injury. Tesla showed unipolar lamps lit in this way so long ago as 1892; but they were of small power. Now he appears to have very considerably improved his performances in this regard. They are still a long way from having any practical issue; but the inventor's ideas are picturesque and grandiose, and may be realized some time in the future. For the present, all the power seems to be expended in producing intensity, which can hardly be kept within the bounds of the apparatus employed, and yet is too local in effect to discharge any useful duty.

FRANK LIVESEY.

It is with profound regret that we record the death, at his home at Reigate, on Wednesday last, the 3rd inst., of Mr. Frank Livesey, the Chief Engineer of the South Metropolitan Gas Company. Mr. Livesey had been away from his post for some months—in fact, had been granted six months' leave of absence, on account of ill-health; and it was known that his illness could only end in one way. Still, the news of his death at the comparatively early age of 55 will be a shock to those professional friends all over the world, to whom the name of Livesey stands for so much in the contemporary history of the gas industry. "Mr. Frank" (as he was commonly styled affectionately by his associates in the South Metropolitan service) was naturally overshadowed to some extent by his elder brother, Mr. George Livesey, the Chairman of the Company; but those who knew him best—among whom the now sorrowing brother must be included—recognized that he possessed a marked individuality, as well as an amiable and engaging character.

Mr. Frank Livesey was the younger son of the late Mr. Thomas Livesey, then Secretary of the South Metropolitan Gas Company. Born at the Old Kent Road on July 6, 1844, the gas-works were literally his playground. He was educated at private schools and at Dulwich College; and he afterwards studied at the King's College Engineering School. Articled to a Mr. J. Fogerty, a Railway Engineer, he spent two or three years in Shropshire on railway work. When Mr. George Livesey was entrusted with the construction of new works for the Tynemouth Gas Company, he took his brother for his assistant and partner in making the drawings, and appointed him Resident Superintendent of the construction works. On their completion, Mr. Frank Livesey became Engineer and Manager to the Company, holding this post until the end of 1872, when he returned to London as assistant to his brother at the Old Kent Road. On the absorption of the Surrey Consumers' Company in 1879, he took entire charge of the works at Rotherhithe, in addition to assisting at the Old Kent Road; and in 1882 he succeeded Mr. George Livesey as Chief Engineer to the Amalgamated South Metropolitan Company.

He commanded the hearty co-operation and help of the loyal staff and servants of the Company on the occasion of the crisis of 1889. Upon him rested the responsibility of all the arrangements for the new manning of the works, and the instruction, lodging, and feeding of the fresh hands. There was not a man in the service, then or afterwards, who would not have done anything for "Mr. Frank." His personal influence went far to ensure the smooth working of the organization which his cool judgment helped to devise.

As an engineer and technician, Mr. Livesey's perceptions were keen; and his constructive ability was of a high order. He had a large part in the design and construction of the East Greenwich Gas-Works. The general plan was settled jointly by the brothers Livesey; but the making of the plans, the disposition of the details, and all the executive work, fell to Mr. Frank's share. He was not a man to "rest and be thankful" while the path of progress lay open. The shallow tank of the 12 million cubic feet gasholder at East Greenwich, which saved pumping and the excavation of a deep trench, was his conception; and he carried out the work by employing the Company's own men—mainly the winter stokers—without a contractor. The introduction of stoking machinery into the Company's works was upon his initiative; and he persevered with the improvement until the new system was made completely successful. Vigilant where capital or revenue expenditure could be economized, he used to say "we must spend money to save it." In this spirit he rebuilt, remodelled, and refitted some of the Company's works and most of the retort-houses. Well aided by the other Engineers and members of the engineering staff, Mr. Frank gave ceaseless attention to the perfecting of details. His work upon retort-settings, gas-furnaces, the hydraulic main, and other divisions of gas-manufacturing plant will be familiar to our readers. It is therefore largely due to him that the South Metropolitan Company stand where they do to-day, as regards capital burden and working results.

He made the great machine and kept it, so far as his department of the management went, in perfect and smooth working order; but he overtaxed his strength, and kept on too long after he should have given up his position. In communicating to us the facts of his brother's professional career, for the purpose of this brief notice, Mr. George Livesey finished his letter with the simple words, "I shall miss him greatly." It is unnecessary to say more. "Mr. Frank" will be greatly missed by many; for a better man, or a kinder soul, is not to be found in the whole personality of the gas industry.

The funeral took place on Saturday, at Buckland. Upwards of a hundred officers and employees of the South Metropolitan Company, with many other personal and professional friends, besides the family mourners, attended the ceremony. This was performed by the Vicar of St. Albans, Streatham Park, of which parish the deceased was for some years Churchwarden. There were no formal invitations to the funeral; and, owing to the smallness of the church, the number of those attending on the part of the 4000 officers and men of the Company's service—every one of whom felt the loss of a friend in Mr. Livesey—was necessarily restricted. Among those present (besides the Chairman) were Captain Heathorn and Messrs. Austin, Butcher, Ewart, Morton, and Simpson Rostron, Directors of the Company; Mr. Frank Bush, Secretary; and Messrs. C. C. Carpenter, Browne, Tysoe, Tanner, Drumgold, Gibbons, Sims, and Surman, and other heads of departments. Also Mr. Corbet Woodall, Mr. G. C. Trewby, and Mr. H. E. Jones.

STATISTICS AS TO THE WORKING OF THE EMPLOYERS' LIABILITY AND WORKMEN'S COMPENSATION ACTS.

With commendable promptitude, the Home Office has issued, as a Parliamentary Paper, the collected statistics of the proceedings in County Courts in England and Wales under the Workmen's Compensation Act, 1897, and the Employers' Liability Act, 1880, during the year 1898. In view of the attempts that are being made to revive in Parliament the whole subject of workmen's compensation for accidents—less it is to be feared in the interest of working people than as a means of manufacturing political capital—it is of the first importance that reliable information respecting the operation of the existing law is available. The newer Act only came into force on July 1 last; and it is pointed out in the "Introductory Note" which prefaces the paper, that after making allowance for the law's delay, the return must be considered as limited to about three months' working of the Act. On the other hand, the tables of cases under the Employers' Liability Act, 1880, are affected by the appearance late in the year of the alternative procedure under the new Act. As yet, therefore, no useful comparison can be made between the number of cases dealt with under the Workmen's Compensation Act and those brought under the Employers' Liability Act. In future it will be desirable, so far as possible, to make this comparison. The tables are therefore prepared for it by being arranged in the form in which it is proposed to continue them, and which, by distinguishing the employments in which the accidents occur, will admit of some comparison between the number of cases in which the workman seeks his remedy under the Acts respectively.

The paper makes the most important admission that whatever comparisons are made in this sense must be subject to the consideration that the two Acts, even in employments to which both apply, do not cover the same ground. Although it is probable that in such employments a claim which succeeds under the Employers' Liability Act would also have succeeded under the Workmen's Compensation Act, this cannot be affirmed with certainty for every case. Nor will it be clear in all cases, though it will in most, whether the employment in which an accident dealt with under the Employers' Liability Act occurs is or is not within the Workmen's Compensation Act. The remark applies specially to the heading "building," in regard to which the newer Act is especially restricted to buildings exceeding 30 feet in height, and such as are "being constructed or repaired by means of a scaffolding, or being demolished, or on which machinery driven by steam, water, or other mechanical power is being used for the purpose of the construction, repair, or demolition thereof." These considerations should be borne in mind by those who endeavour to draw inferences respecting the value of the Workmen's Compensation Act from statistics of cases brought under this and other Acts.

The correct way of looking at the new Act is to regard it as an addition to employers' responsibilities and workpeople's rights previously existing. It is not an unlimited addition, by any means, but bears on its face the caution that it must be construed and applied within certain limitations, which are indicated and defined. It has always appeared to us that if people who have to do with the Act would only treat it in this spirit, they would not discover in it anything like the confusion and bad draughting that some hasty individuals on and off the Bench have found. One can understand that a professed Socialist, or political opponent of the party that passed the Act, would naturally find fault with it; but for men of business the only question of real interest is to ascertain what are the limitations of a law which can never be rightly understood unless the fact of its being limited is accepted to start with. Hence the first beginnings of such an extension of the mutual rights and liabilities of certain orders of the community must be marked by the emergence of curious questions along the border line, which would not appear if the law were of general application. Those who complain that the Act is another complication of the law of employer and employed, inasmuch as it leaves all the older ways of litigation untouched, forget that this is the rule of English statute-making. Very few Bills touching the rights or liabilities of the subject would get past this stage if they proposed to abolish everything that had gone before and to lay down a nice, even, plain course, like a turnpike road, for attaining the desired object. This is the way the logical French mind makes laws; but the English law maker, when he wants to effect a legal improvement, prefers to leave the old way open, so far as it is good and convenient, while offering his presumably easier road.

For these and other reasons that might be mentioned, the promised annual Parliamentary Returns will need to be taken for what they may be worth as a partial indication of the extent to which the Workmen's Compensation Act is operating. As a

matter of fact, however, the Act will be found to operate over a very much larger field than can be registered by tables. Under the Act the amount of compensation may be settled by agreement, and, failing this, by two sorts of arbitration. First, an informal arbitration by a single arbitrator chosen by the parties, or by a committee representative of employers and workmen; and, secondly, by a formal arbitration under the County Court Rules. It is only of the latter that a complete record exists. A memorandum of an informal agreement or decision may be registered in the County Court; but not compulsorily. Where this is not done, the result will not appear in the annual tables.

The first Paper of the kind is brought forward prominently in these columns less for its intrinsic value than for the sake of letting our readers know that this is another annual return which employers of labour will be well advised to file regularly. A complete return of all the cases decided up to the end of last year cannot supply material for many conclusions. Even so, although the statistics deal with so short a period and with small figures, some of them are not devoid of suggestion. Of 130 cases finally settled within the cognizance of the Courts, the decision in 101 cases was for the plaintiff and in 29 for the defendant. In 38 of these cases, the compensation was awarded on account of death; and the total amount was £7604, or an average of £200 per head. These figures relate to cases where the deceased left dependants. A matter in regard to which employers are reasonably anxious is the payment for total disablement. Whether it is cheaper to kill a man outright or to permanently disable him may not be a nice sounding query to humanitarian ears; but, in business, everything comes down at last to the financial bearings. The present return does not contain the material necessary for determining this question; but it seems tolerably clear that, as has been expected, complete disablement is more expensive than death. That it is equally bad for the victim is, notoriously, recognized by the Accident Insurance Companies, who pay the full sum assured on proof of certain terrible and unmistakable injuries. The question is considerably varied in regard to what constitutes incapacity for following an industrial employment. Still, in many cases, it would doubtless be better for all concerned to treat total incapacity as death, and at once wipe off the liability accordingly.

Up to the end of the year, there were 16 settled cases of total, and 37 cases of partial, incapacity. The average amount awarded in the former was 11s. 4d. a week, in the latter 12s. 10d. In factory cases, the averages were 10s. 9d. and 12s. 5d.; for miners, the figures were 12s. 2d. and 13s. 5d. It is allowed to be somewhat remarkable that the average payment for total incapacity should be less than that for partial incapacity. Probably the explanation is that partial incapacity usually means temporary incapacity; and that, in cases of the latter description, the employer does not strongly object to pay the full amount allowed under the Act—that is, half wages. On the other hand, the cases of total incapacity include a larger proportion of cases of permanent disablement in which a smaller allowance than the maximum under the Act meets the justice of the liability. This is a matter that cannot safely be subjected to generalization for several years. There is good reason to believe that where employers and employed are antagonized, as by the influence of a powerful trade union, the presumption of total disablement will be oftener raised than in different circumstances. The policy of the trade union will be to retire as many injured members as possible at the employers' expense. The unions want only able-bodied members, at full rates. The old-fashioned humanitarian custom of permitting old and maimed workmen to potter about the works, doing and earning what they can, is not in agreement with trade union principles. Consequently, the unions wherever they have the power will "put the screw on" employers to convert permanent partial incapacity into total disability to work. Some allowance should be made for this when counter-charges are preferred against employers of restricting their engagements to able-bodied men. Really, the desires of employers and trade unions in this respect are identical; but inasmuch as decrepitude and maimed powers are incidents of humanity that cannot be avoided, each party desires the other to assume the burden of these disadvantages. It is not a pretty story; but unhappily it is a true one, and the facts will be none the softer for being hidden.

Lastly, there is the pointed question of whether workmen should proceed for compensation, in case of dispute, under the Employers' Liability Act or the Workmen's Compensation Act. As already explained, each Act is both wider and narrower than the other. It is reported that up to the end of last year the operation of the new Act had not sensibly affected the amount of litigation under the Act of 1880. There were 681 cases, all heard in County Courts; and the average amount of damages in the event of death amounted to only £85, as compared with £200 under the new Act. Moreover, the law costs under the older Act were just double the average under the new one. So much for one of the most general complaints against the Act of 1897—that it encourages litigation. In conclusion, it should be repeated that the most serious mistake that could be made with regard to these returns is to imagine that the cases which come before the County Courts represent any considerable proportion of the cases of compensation paid, and paid in full. The number of disputed cases is estimated to be considerably less than 1 per cent. of the whole; and even of these some were of the nature of friendly actions, not to dispute payment, but to settle the question of the person to whom the payment should be made. The report is emphatic as to the good-will with which the intention of the Legislature, as expressed or indicated in the Act, has been carried out by employers generally. This verdict is supported both by the records of the County Courts, and also by the absence of contested cases in large districts. There are some districts where the registration of agreements under the Act appears to be customary, as in the Stokesley and Guisborough district, with a mining population. Here, without a single case being carried into Court, 80 cases of compensation were registered. On the other hand, there was not a single recorded case from the mining districts of Durham, Consett, and Bishops Auckland; nor from South Staffordshire, Plymouth, Devon, and Cornwall. Unless one is to accept the preposterous premiss that no industrial accidents whatever occurred in these large and populous regions, the negative evidence shows that the Act is working here by itself. One cannot but be relieved to hear such good news, on official authority. We, at any rate, who have applauded the Act through good and evil report, are glad to be confirmed in the faith in its successful operation. Henceforward, it will be easier to place in their true value those incidental disputes—sometimes really "hard cases"—which politicians in want of a popular cry, and labour agitators who find the Act making against their influence, occasionally strive to inflate into causes of disturbance of this provisional settlement of an old industrial grievance.

WOODEN WATER-PIPES.

THE paragraph in the "JOURNAL" for the 11th ult. recording the unearthing, near the Marble Arch, of some of the old wooden pipes once used for the supply of water to London, has brought out in our "Correspondence" columns some interesting technical particulars in connection with this primitive method of conveying water to the consumers. Some further details are supplied by an article which recently appeared in the "Standard;" and we reproduce them as supplementing the information already furnished.

The depth at which the wooden pipes are found varies from 2 to 3 feet, and their bore ranges from 5 to 7 inches. In Park Lane, the workmen came upon a double line of wooden pipes one line forming a bye-pass, joined to the main at each end by a curved junction made of cast iron. The wood was in all cases either elm or oak, in lengths ranging between 4 and 15 feet. The several sections were neatly fitted together—one end having the external diameter reduced, so as to fit into the next pipe, which had its bore enlarged. The workmanship was good for its purpose, though the pipes were rough in their exterior—the bark being allowed to remain.

It appears that wooden water-pipes date back at least to the time of Peter Moris, a Dutchman, who in the year 1582 erected a water-wheel under an arch of London Bridge, to work pumps to force the Thames water into the pipes, by which it was conveyed to houses at the east end of the City as far as Gracechurch Street. Similar means were subsequently employed for the distribution of the water of the New River, which was brought to London by Sir Hugh Myddelton. The work was one of considerable difficulty. According to an old writer, the supply was effected "with all possible diligence, by pipes of elme and lead, but for the most part elme, from which pipes many high streats and lanes within the City are plentifully served." Respecting the service-pipes, there is the record of a lease, granted in 1616, by Myddelton to a citizen and his wife, "of a pipe or quill of half-inch bore, for the service of their yarde and kitchine by means of two swan-necked cocks." For this a certain sum was to be paid yearly. In all probability, similar arrangements were in use over the entire Metropolis in connection with later water-supply undertakings. The cheapness of the wooden pipes, as compared with iron ones, was doubtless a predominating consideration with the conductors of those undertakings.

The work which has brought these curious relics to light is the laying, by Messrs. John Aird and Sons, for the Grand Junction Water Company, of a 24-inch main along Oxford Street, to join the New River Company's system at Poland Street; these two Companies being associated, it will be remembered, with the West Middlesex Company in the Staines reservoirs scheme. Messrs. Aird's workmen are now taking up wooden pipes in Oxford Circus; and they have come across similar relics in the district of the East London Water Company, about West Ham. In that instance some pipes made of fir were found, with a bore of only 3 inches.

The article above alluded to brought from Mr. J. W. Ford, of Winchmore Hill, some interesting particulars as to the substitution of iron pipes for wooden ones in the district of the New River Company. It appears from a letter which appeared in our contemporary on the 1st inst. that the last outlay on elm pipes by the Company was in 1816, previous to which date the annual expenditure for these had been from £5000 to £6000. Shortly before this it had been determined to substitute iron for wood; and Mr. Vansittart, the Chancellor of the Exchequer, gave the Company a letter to the Bank of England, authorizing a loan of £100,000, on condition that the money was expended

in iron from the Staffordshire foundries; the Government being induced to take this step by the great depression in the iron trade of the country. There was great opposition to the proposal; it being gravely asserted, and no doubt believed, that the consumption of water through iron pipes would produce cancer. At that date, the 50 acres of land owned by the Company round their "Head" in Clerkenwell was covered with a huge network of wooden pipes, "like the threads of a garment," as Mr. Mylne, the Engineer, described it before a Committee of the House of Commons in 1851. These were all removed when the new iron pipes were substituted. The rows of lopped elm trees, formerly so common in the neighbourhood of London, are believed to have owed their origin to the great demand for long straight trees, which were bored for the Water Companies' pipes.

As the writer of the article in the "Standard" justly remarks, important changes have come over the water supply of London since the trunks of trees were utilized in connection with it. We may add that in our day, with a supply of 25 gallons of water per head, the cry is raised of a "famine;" and with water constantly certified by eminent chemists to be all that can be desired for domestic purposes, we are told that we are drinking "liquid sewage." When these wooden pipes were put down, the supply must have been very limited, judging from the smallness of the bore compared with that of the pipe now being laid; and it may well be supposed that the material of which they were formed was less calculated to ensure purity than that now employed. Of course, the growth of the population and the advance of knowledge have necessitated changes in the methods of supplying water; and we venture to think that those who have charge of this important work in the Metropolis have not been lax in adapting their works and plant to the altered conditions.

OBITUARY.

The death is announced of Mr. JOSEPH SLOCOMBE, until recently of the firm of Messrs. Howard S. Smith, Slocombe, and Co., chartered accountants, of Birmingham. Mr. Slocombe, who was widely known and respected in Birmingham, managed the liquidation of the old Birmingham Banking Company in 1866, and was subsequently appointed Secretary of the Birmingham Gas Company. On the gas-works being taken over by the Corporation, he was again offered the secretaryship, but declined, preferring to practice as an accountant. The deceased gentleman was 59 years of age; and his death occurred at Bournemouth last Friday week.

PERSONAL.

Mr. W. J. JEEVES, of St. Helens, has been appointed Town Clerk of Leeds, in succession to Mr. J. Harrison, who recently resigned.

The Berlin correspondent of the "Standard" reports that Dr. ROBERT WILHELM BUNSEN, the well-known Professor of Chemistry at the University of Heidelberg, who was born at Göttingen, in 1811, is extremely ill, and all hope of his recovery has been abandoned.

Mr. E. HOWELL, the Manager of the Yeovil Gas-Works, is to retain this position under the Corporation from the 1st of July next. Mr. Howell will receive £2000 under the compensation arrangement; and his salary under the Corporation will be £250 per annum, with gas for his house and the use of a garden.

An interesting gathering of the officials of the Sheffield Gas Company took place last Wednesday evening, in the large office, when a gold watch, an umbrella, and a walking-stick were presented to Mr. JOHN SEDDON, on his retirement from the Company, after 47 years' service. Mr. Hanbury Thomas, the General Manager, presided, and in making the presentation, gave an interesting account of the growth of the undertaking during the past half century. He referred to the good feeling both he and the officials had towards Mr. Seddon; and expressed the hope that Mrs. Seddon and himself might long live to enjoy their well-earned rest. Mr. Seddon feelingly responded, and gave some reminiscences of his connection with the Company.

The entry, on Saturday, the 30th ult., of Mr. CHARLES SELLERS, of York, upon his fiftieth year of service with the York Gas Company, was deemed by the workmen a fitting occasion for expressing their regard and esteem for him, by asking his acceptance of a silver-mounted walking-stick and an illuminated address. The presentations were made by Mr. J. Burdett and Mr. W. Leadley. Mr. Sellers, in acknowledging the gifts, said they were very valuable, not so much for their intrinsic worth as for the feelings they conveyed to his mind. He felt that the occasion marked one of the bright spots in his life's connection with the Company, and especially with the workmen; and he hoped most sincerely that nothing would ever come between the gifts they had made to him and the compliments they had endorsed on them to spoil the pleasure he then felt. He thanked all who had taken part in this expression of their regard for him.

Manchester District Institution of Gas Engineers.—We learn from the Hon. Secretary of the Institution (Mr. S. S. Mellor, of Northwich) that the forthcoming quarterly meeting will be held at Kendal, on Saturday, the 3rd prox.

TECHNICAL RECORD.

CONTRIBUTIONS TO GAS ANALYSIS.

The following is an abstract-translation of a recent communication by Dr. Otto Pfeiffer, of Magdeburg, to the "Journal für Gasbeleuchtung," on the analysis of illuminating gas.

Bunsen's procedure for the analysis of coal gas consisted in absorbing the carbonic acid and heavy hydrocarbons, and determining the remaining constituents—carbonic oxide, hydrogen, marsh gas, and nitrogen—by explosion with air. The contraction (C), the carbonic acid formed (CO_2), and the total residual nitrogen (N_2) after deducting the excess of oxygen, were measured after the explosion. The last volume (N_2), after deducting from it the known volume of nitrogen (N_1) in the air added before the explosion, gave the volume of nitrogen (N) in the residual gas. On deducting this volume (N) from the volume of residual gas, the volume of the combustible mixture (V) was known. The following equations then gave the volumes of combustible gases:

$$\begin{aligned} \text{Carbonic oxide} &= \tfrac{1}{3}\,CO_2 + V - \tfrac{2}{3}\,C \\ \text{Marsh gas} &= \tfrac{2}{3}\,(CO_2 + C) - V \\ \text{Hydrogen} &= V - CO_2 \end{aligned}$$

This simple procedure of Bunsen is now but little followed, partly because methods for the estimation of single constituents have been introduced, and partly because the errors of observation are many times multiplied, because a small portion only of the sample of gas is taken for the explosion. The author, however, thinks that in discarding the explosion method many good features have been given up along with the bad ones, and that the methods now preferred have faults which equally vitiate the final results. The generally adopted plan of absorbing carbonic oxide by means of cuprous chloride, is tedious and inexact, as both Drehschmidt and Winkler have already pointed out. Fractional combustion of the hydrogen and marsh gas leads to a further complication arising from the errors introduced by the multiplication of the readings, and the loss of time. Moreover, analyses carried out by these methods give very uncertain and improbable values for the nitrogen (0·5 to 4 per cent.) in coal gas; since the nitrogen is found merely by difference, and all the errors of the other determinations affect its value. The author's confidence in the explosion method is based on the conviction derived in the course of a large series of coal gas analyses, that the results therefrom are completely satisfactory, and are rapidly arrived at—provided the conditions stated below are adhered to. A most important condition is the taking of a larger amount of the gaseous residue for the explosion than is customary; and this can readily be carried out if the apparatus is properly chosen. Neither the apparatus nor its manipulation is entirely novel; but it may fitly be briefly described by the aid of illustrations.

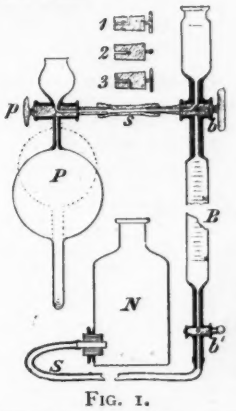


FIG. 1.

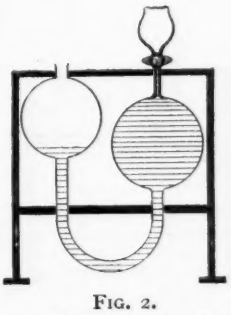


FIG. 2.

A Bunte burette B (fig. 1) serves as the measuring vessel; but its lower end is permanently connected, by flexible tubing S, with a levelling-bottle N. The confining water is coloured pink by a few drops of sulphuric acid and tincture of litmus; and a check is thus afforded on the absorption of carbonic acid by the water. The transverse perforation of the upper stopcock is blocked up with grease, so that only the longitudinal perforation remains open. The absorption pipette P (of which a side view is given in fig. 1, and a front view, with stand, in fig. 2) differs from the common patterns in having a stopcock *p*, longitudinally perforated, and a funnel, similar to the corresponding cock and funnel at the top of the Bunte burette. This arrangement avoids the objectionable space which occurs when the old forms of pipette are coupled up with the burette. Bleier and Buisson have both used a similar device.

When the sample of gas measured in the burette is to be transferred to the pipette, the air is first expelled from the connecting cocks and flexible tube *b-s-p*. (briefly referred to in the sequel as "the connection") by turning both cocks into the position indicated by 1 (fig. 1) and pouring water into one funnel until it rises to the same height in the other funnel. Then the cock of the pipette (*p*) is turned by 90° to the position indicated by 2, and the cock of the burette *b* by 180° to the position 3; and the gas is put under pressure in the burette by raising the

TABLE I.

—	Readings.	Data for Calculations.	Volumes of Constituents of (R).	Constituents.	Volumes per Cent.
A.—*Absorptions.*					
(*a*) At starting	0·0	..	(9) Factor $\frac{G}{R}$ = 4·617	..	
(*b*) After absorption with solution of caustic potash	1·7	..	..	Carbonic acid	1·70
(*c*) After absorption with fuming sulphuric acid	5·1	(7) G_1 = 94·90 (8) G = 94·67	..	Heavy hydrocarbons	3·40
B.—*Explosion.*					
(*d*) Residual gas taken (R)	20·5	(4) V = 20·17	Carbonic oxide 1·91	Carbonic oxide	8·90
(*e*) Air taken	109·9	(1) N_1 = 86·87	Marsh gas 6·10	Marsh gas	28·10
(*f*) After explosion	1·0	(5) C = 31·40	Hydrogen 12·17	Hydrogen	56·20
(*g*) After absorption with solution of caustic potash	9·0	(6) CO_2 = 8·00	..		
(*h*) After absorption with phosphorus	12·8	(2) N_2 = 87·20 (3) N = 0·33	.. Nitrogen 0·33	Nitrogen	1·50
			R = 20·51		
C.—*Oxygen Determination.*					
(*i*) 14 drops of standard colour solution	..	..	..	Oxygen	0·23
					100·03

TABLE II.

—	Readings.				Data for Calculations.				
	I.	II.	III.	IV.		I.	II.	III.	IV.
Residual gas taken (R)	20·500	20·600	20·300	21·500	V =	20·17	20·35	19·97	21·07
Air taken	109·900	110·000	109·900	109·900	N_1 =	86·87	86·95	86·87	86·87
After explosion	1·000	1·000	0·700	1·200	C =	31·40	31·60	30·90	32·60
After absorption with solution of caustic potash	9·000	9·100	8·700	9·600	CO_2 =	8·00	8 10	8·00	8·40
After absorption with phosphorus	12·800	12·800	12·800	12·700	N_2 =	87·20	87·20	87·20	87·30
Factor $\frac{G}{R}$	4·617	4·595	4·663	4·403	N =	0·33	0·25	0·33	0·43
In the residual gas (R)	..	..	..	..	In 100 volumes of gas	..	..	..	..
Carbonic oxide	1·910	1·980	2·040	2·140	..	**8·90**	**9·10**	**9·50**	**9·40**
Marsh gas	6·100	6·120	5·960	6·260	..	**28·10**	**28·10**	**27·80**	**27·60**
Hydrogen	12·170	12·250	11·970	12·670	..	**56·20**	**56·30**	**55·80**	**55·80**
Nitrogen	0·330	0·250	0·330	0·430	..	**1·50**	**1·20**	**1·50**	**1·90**

levelling-bottle. By carefully turning the cock of pipette *p* from position 2 to position 1, the water in the connection is completely expelled by the gas through the funnel of the pipette, without loss of gas. The cock of the pipette is then turned by 180° to position 3, and the gas passes over into the pipette; as soon as the confining water reaches the end of the connection, the flow is stopped by turning the lower stopcock *b*. On passing back the gas to the burette by lowering the levelling-bottle and opening the cock *b*, the absorbent is allowed to rise in the capillary of the burette as far as the cock *p*, which is then turned by 180° to the position 1; whereupon the water in the funnel expels the gas from the connection into the burette. When the connection is completely filled with water, the cock *p* first, and the cock *b* next, are both turned to the position 2.

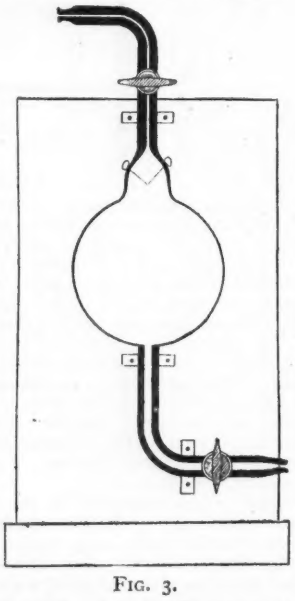


FIG. 3.

The explosion pipette (fig. 3) differs from the common pattern in having a smaller capacity (150 c.c.), so that it takes only about 20 to 22 c.c. of the gaseous residue and about 110 c.c. of air. The production of a thick-walled bulb by the glass blower thus becomes easy; and the quantity of mercury used is diminished by about two-thirds. Consequently the total weight is reduced. The pipette is provided with two stopcocks, and a piece of flexible tubing for coupling up its capillary with the burette. A levelling-bottle is used similar to the one employed with the burette.

The following may be added to the general precautions to be observed in working. The absorption of carbonic acid may be regarded as completed in one minute at the longest; that of the heavy hydrocarbons by fuming sulphuric acid in five minutes with occasional agitation. The gas must be then passed into the pipette containing solution of caustic potash, as the tension of the acid vapours may otherwise readily cause an error of 0·5 per cent. The volume of gas is read about a minute after the level has been adjusted by means of the levelling-bottle and the cock *b* of the burette. While waiting to make a reading, the preparations for the next operation may be completed.

In dealing with the gaseous residue, 20 c.c., or at the most 22 c.c., are first driven into the explosion pipette; and the capillary is filled with water. Then the upper cock of the pipette is closed, the connection is severed, and the burette is filled with air to the lowermost line on it; giving a volume of 110 c.c. The connection is then refilled with water from the funnel, and the explosion pipette is again attached. The cock of the burette is then turned by 180° to position 3; and the gas in the pipette is put under a slight pressure, in order to drive the water in the connection into the burette, and thus prevent the absorption by water in the pipette of carbonic acid formed in the explosion. The air is then passed into the pipette, the connection is just filled with water, and the upper cock on the pipette is closed. The lower cock is closed as soon as the mercury has passed out of the bulb, and stands only in the bottom tube. The volumes of gaseous residue and air are so proportioned that the products of the explosion measure about 100 c.c.—a volume which can be conveniently read off in the burette. If in passing the products into the burette, some mercury has been also passed into it, it should be run out of the burette and flexible tubing into the levelling vessel, where it can remain, and will be without influence on the working of the apparatus.

After the contraction has been ascertained, there follow the estimation of the carbonic acid formed in the explosion and the removal of the excess of oxygen. The absorption of the latter by phosphorus is completed at ordinary temperatures in five minutes. If it is necessary to warm the pipette in order to start this absorption, the heat of the hand will suffice. Subsequent treatment with solution of caustic potash is unnecessary, even though phosphoric acid remain visible in the gas. The tension of phosphorus vapour is also without influence on the result.

The oxygen in coal gas is estimated by the author on a separate sample according to his calorimetric method.* Herr Lubberger has objected to this method on the ground that the caramel solution used as the standard of comparison is not unchangeable. The author has overcome this objection by using decinormal solution of iodine (two parts potassium iodide to one part of iodine), which gives precisely the desired tint, and is stable and readily checked.

The results of a complete analysis of coal gas are given in Table I., together with the figures obtained at the successive operations, and the data required for the calculations.

The following references to the data for the calculations indicate simple means of carrying out the latter:—

(1) The volume of nitrogen (N_1) in the air (e) taken for the explosion is rapidly found from a table which gives the corresponding volumes, as in the following example:—

109·50	—·60	—·70	—·80	—·90	110·0 c.c. air.
85·56	—·63	—·71	—·79	—·87	—·95 c.c. nitrogen.

(2) The total nitrogen (N_2) = 100—h

(3) The nitrogen in the residual gas (R) = N_2—N_1

(4) Combustible portion (V) = d—N

(5) Contraction (C) = ($d + e + f$)—100

(6) Carbonic acid from the combustion (CO_2) = g—f

(7) Residual gas after the absorptions (G_1) = 100—c

(8) Residual gas (G) = G_1—oxygen in the gas.

(9) The quotient $\frac{G}{R}$ is the factor by which the volumes of constituents in the residual gas are converted into volumes per cent. on the whole sample. If the oxygen determination, which affects the final result but little, is omitted, then the factor $\frac{G_1}{R}$ is used.

In order to indicate the concordance which prevails between the results obtained by this explosion method, the residual gas in the sample of which the analysis has been given was divided into four portions, each of about 20 c.c.; and the results of the analysis of each portion are set side by side in Table II.

That the method is trustworthy, is also indicated by the fact that a series of twelve analyses of coal gas made at the Magdeburg Gas-Works during a period of twenty weeks show very small variations. The gas was made from Westphalian coal, and was not enriched. The constituents varied according to these analyses within the following limits (volumes per cent.): Hydrogen, 53·5 to 55·2; marsh gas, 29·2 to 31·3; carbonic oxide, 7·7 to 9·1; and nitrogen, 1·1 to 2·5.

The analysis of a sample of gas by this method occupies from 45 to 50 minutes. Such an analysis, and determinations of the oxygen in, and the specific gravity, the calorific value, and the illuminating power of, the gas can all be completed within two hours.

* See "JOURNAL," Vol. LXX., p. 370.

USE OF COKE-OVEN GAS FOR ILLUMINATING PURPOSES.

The following is an abstract translation of a contribution on this subject by Dr. Carl Schmidt to a recent number of the "Journal für Gasbeleuchtung."

Large quantities of gas are produced when coal is carbonized in coke ovens. In those ovens which have no provision for the recovery of bye-products, this gas is consumed forthwith for the purpose of heating the ovens. But as the gas contains ammonia, tar, benzol, and other valuable products, which are lost when the gas is thus consumed, there has lately sprung up a new industry of coke production, in which, as in a gas-works, the gas evolved is freed from tar and ammonia before it is consumed. The cooling and washing of the gas rob it, however, of a great part of its heating value, so far as heating the ovens is concerned. The construction of the ovens, however, has been so greatly improved that not only does the gas suffice for heating them, but there is also a surplus available for other uses. Generally this surplus is utilized as a fuel for boilers or gas-engines. So far, it has been but little used for illuminating purposes, as its illuminating power does not generally exceed about 6 candles; and if the ovens are old and leaky it is even considerably lower. But the gas may be carburetted with benzol, and used as illuminating gas. For instance, carburetted coke-oven gas from the Erin mine is supplied for the lighting of Castrop. But the amount of benzol required for carburetting the gas is very considerable. For example, to raise gas of 5¼-candle power to 14-candle power requires an expenditure of 1·9 to 2·5 lbs. of benzol per 1000 cubic feet of gas. It has, however, long been recognized in gas-works that the gas which is evolved from coal in the initial stages of its destructive distillation is possessed of much higher illuminating value than that evolved later. Recently, attempts have been made to separate the gas evolved at different periods from coke-ovens into two portions; so that that which comes off in the early stages may be used for illuminating purposes, for which it is suitable, and that which comes off subsequently may be used for heating the ovens. A paper dealing with two large-scale experiments in this direction in North America has been lately prepared by Mr. H. O. Hofman for the "Engineering and Mining Journal." (It may be mentioned that the substance of Mr. Hofman's paper was given in the "JOURNAL" for Nov. 22 last, p. 1155.)

Mr. Hofman, however, in attempting to draw conclusions as to the relative economy of gas-works and coke-oven practice in carbonizing coal, by tracing the distribution of the heating value of the coal in the various products, forms the opinion that the coke-oven practice is the more economical. He, however, only compared the results obtained at the coke-ovens with figures given by Herr W. von Oechelhaeuser for gas-works practice; and these figures do not tally with the heat-balance drawn up by M. Mahler for gas-works carbonization ("see Comptes Rendus," CXIII., p. 862). M. Mahler found that the heating value of the coal was distributed among the several products of gas-retort carbonization in the following proportions: In the coke, 62·1 per cent.; in the tar, 8·9 per cent.; in the gas, 25·5 per cent.; and in the liquor and purifying agents, and unaccounted for, 3·5 per cent. If Herr von Oechelhaeuser's statement that 10·1 per cent. of the heating value of the coal is used up in maintaining the heats of the retorts be taken as correct, it appears from M. Mahler's figures that 10·1 + 3·5 = 13·6 per cent. of the heating value of the coal is consumed or lost in the process of carbonization as conducted in gas-works. The corresponding figure found by Mr. Hofman for coke-oven procedure is 10·9 per cent., which is not far removed from that deduced from M. Mahler's figures for gas-works procedure. Hence there appears to be no considerable difference in the economy of the two processes as indicated by the heat-balance in each case.

The results given by Mr. Hofman for the treatment of American coal in coke-ovens, have led to a consideration of the question whether the vast quantities of gas produced in the coke-ovens on the German coalfields cannot advantageously be separated into two portions, of which one shall be suitable for illuminating purposes. The composition of the gas obtained from the coke-ovens is practically the same whether the coal dealt with is that of the Rühr district of Germany or the American coal considered by Mr. Hofman. The gas differs from that obtained in gas-works in some respects. The amount of nitrogen in it is large, because the walls of the oven are not sound enough to prevent the fuel gases passing through whenever the pressure within the oven falls, and because a lower pressure is maintained in the oven than in a gas-retort. The gasification is more thorough in coke-ovens than in gas-retorts; and the gas given off towards the end of the coking process contains more hydrogen and less marsh gas than coal gas contains. The calorific value of coke-oven gas, either from Rühr coal or Cape Breton coal, falls from nearly 170 calories per cubic foot in the first three hours to about 70 calories during the thirty-second hour after charging.

The Rühr coal from the Mathias-Stinnes mine near Essen contains 13·5 per cent. of water. The percentage of ash in the dry coal is 7·5. In modern Otto ovens, without regenerative firing, the charge per oven amounts to 6 tons; and it is worked off in 32 hours. The average yields expressed in percentages of the coal are: Coke 73·0 per cent., tar 4 per cent., and sulphate of ammonia 1·5 per cent. The temperature at the walls of the oven, observed with a Le Chatelier pyrometer, ranges from 1050° to 1250° C (say 1920° to 2280° Fahr.). Coke-ovens up to the present have only been heated by the gas produced in them, consequently the only gas available for illuminating purposes is whatever difference there may be between the quantity produced and the quantity needed to maintain the heats. The amount of this surplus gas varies greatly with the type of oven, the variety of coal, and the percentage of water in the coal. In the Rühr district, the surplus may range from 0 to 25 per cent. of the gas produced. A surplus of 50 per cent., as observed in America, is never experienced in the German ovens.

With the same type of oven, the surplus gas will increase with those descriptions of coal which yield most gas and produce good coke at low heats. The products of carbonization do not absorb more heat than that which is needed to raise the temperature, as M. Mahler has proved. The temperature to which coal must be raised to bring about the conversion varies, however, with the description of coal. The higher is its temperature of carbonization, the greater naturally must be the heat supplied to produce and maintain that temperature. Thus it is well known that poor gas-making coals, which yield about 80 per cent. of coke, must be carbonized at higher temperatures than rich gas-making coals. The assumption that therefore rich gas-making coals are most suitable for coke-oven use is, however, not substantiated. Poor gas-making glance coal yields well-fused foundry coke at 900° to 1000° C.; while at this temperature open burning gas coal yields a black, porous coke. At 1100° to 1200° C., however, the latter coal yields well-fused hard coke. A greater surplus of gas can generally be obtained from a rich, than from a poor, gas-making coal. The coke from the rich coal, however, is inferior to that from good glance coal, because it is more porous; and as the coke is the staple product of coke-ovens, rich gas-making coals have so far been little used in coke manufacture.

Recently, however, at some coke-ovens where rich gas coal is dealt with, Quaglio's process for ramming or pressing the coal before it is put in the ovens has been found serviceable. The coke thus obtained is better for metallurgical use than coke from the untreated coal, as it is less porous. Moreover the charge may be increased by 20 per cent.; while the time of carbonization is only extended by 5 per cent.

The type of oven has great influence on the surplus quantity of gas. Ovens in which the fuel gases are distributed uniformly among the heating passages, and in which the secondary air is most highly heated, require the least gas. The effect of regeneration on the amount of the surplus gas can readily be seen from an example: A coke-oven, without regenerative working, needs the whole of the gas produced as fuel; say, per ton of coal, 9685 cubic feet of gas, having a calorific value of 127½ calories per cubic foot. The heating value of the fuel used per ton of coal is therefore $9685 \times 127{\cdot}5 = 1{,}234{,}837$ calories. But if the air needed for the combustion of the gas is first heated to say 700° C., some of this fuel can be saved. The air needed is 5 times the volume of the gas; and each cubic foot of air at 700° C. brings 6·1 calories to the oven. Therefore to the calorific value of each cubic foot of gas are added $5 \times 6{\cdot}1 = 30{\cdot}5$ calories; making a total of $127{\cdot}5 + 30{\cdot}5 = 158$ calories per cubic foot, instead of only 127·5 when regenerative working is not adopted. Thus to supply the necessary 1,234,837 calories for the carbonization of a ton of coal, there are needed $1{,}234{,}837 \div 158 = 7815$ cubic feet of gas. The saving effected—viz., $9685 - 7815 = 1870$ cubic feet—will be a surplus when regenerative working is adopted, and will be available for illuminating purposes.

The disastrous effects caused by a large percentage of water in the coal have frequently been pointed out (see "JOURNAL" *ante* p. 364); but with washed coal it is often impossible to secure it nearly dry. The much lower cost of working of coke-ovens compared with gas-retorts, and the increasing demand for cheap gas, will lead to further experiments being made in Germany on the lines of the trials described by Mr. Hofman in America, with a view to a better utilization of coke-oven gas. Given a good type of oven and suitable coal, undoubtedly illuminating gas can be produced in coke-ovens, which is not inferior to the coal gas from gas retorts, at a very much lower cost.

The Manufacture of Soot as a Bye-Product in Gas-Works.—According to Mr. Francis Jehl, writing in the "Electrician," a hitherto unexploited bye-product of gas-works might be found in soot, or lampblack. Besides its other and more familiar uses, this substance is the proximate raw material out of which the carbons for electric lighting are manufactured. Tar is burnt to soot in many rough-and-ready factories, in which the plant is of the simplest description; and Mr. Jehl thinks that soot could be made in this way more cheaply in gas-works than anywhere else. It is necessary that the tar so burnt should be free from water, which would otherwise be distilled over and condense in the soot chambers, while at the same time interfering with the fire. In practice, the tar is warmed up in tanks, when the water settles to the bottom, whence it is let out from time to time by suitable stopcocks. The amount of soot produced from a given quantity of tar is chiefly a question of the method of burning. The weight of soot in the dense black smoke coming from a chimney that would bring the police about the owner's ears in any English town is almost infinitesimal; and Dr. Köhler does not hold out the expectation that more than from 15 to 18 per cent. of the weight of burnt tar could be recovered in this form. Some place the soot-efficiency as high as 20 or 25 per cent. The residue is mostly coke. The soot is collected either in long settling-chambers, or by allowing the smoky flame to impinge upon cold surfaces. The profit on the manufacture is estimated at from 6s. to 7s. per ton; but unfortunately, the process is noxious, as usually conducted, although Mr. Jehl thinks it might be improved.

Messrs. C. & W. Walker, Limited.—In another part of the "JOURNAL" will be found the abridged prospectus of a Company which has been formed, under the above title, with a capital of £100,000, divided into 10,000 5½ per cent. cumulative preference shares of £5 each, and a like number of ordinary shares of similar nominal amount, to acquire the undertaking which has been for so many years carried on as the Midland Iron-Works at Donnington, near Newport, Shropshire. The character of the work done by this important firm need not be referred to here—it is known the world over; but its extent may be estimated from the statement that about 700 hands are employed, and that all the departments are now fully occupied. Mr. A. Featherstone, who has been in the service of the firm a quarter of a century, and has had the management for the past eight years, will become Managing-Director of the Company. The assets, exclusive of goodwill, have been valued by Mr. A. Smith, of Birmingham, at £75,404; and Messrs. Caldicott, Hill, and Harrison certify that the average annual net profit for the past ten years has been £8038, while for the years 1897 and 1898 the profits were £9226 and £10,479 respectively. It is estimated that £6200 would be required to pay the interest on the debentures (£20,000, at 4 per cent.) which will be taken by the Executors of the late Mr. Charles Clement Walker, who are the vendors, and on the preference shares, and also 8 per cent. on the ordinary shares; and on the basis of the profits for last year, there would be left about £4300 for Directors' fees, &c. The Chairman of the Company is Mr. J. F. Wright, Managing-Director of Messrs. John Wright and Co, of Birmingham; the other members of the Board (in addition to Mr. Featherstone) being Mr. W. Perrott, Managing-Director of the Lilleshall Iron Company, Limited, and Mr. C. H. Wright, a Director of the East Cannock Colliery Company, Limited. The present issue consists of 8000 preference and 8000 ordinary shares. The lists open next Monday, and close on Tuesday.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

Incandescent Gas v. Electric Lighting for Streets.—The Value of Creosote for Coating Woodwork.

SIR,—The remarks in your issue of the 2nd inst. on "The Light of the Future for Streets," are very interesting at the present time. Although we had an installation of incandescent street lighting going on at Southampton for some time, it brought forth no practical result, as the Lighting Authority became possessors of the Electric Light Company's undertaking, and were determined to be "up to date"—I believe that is the correct term; and they have started an electric arc installation on the usual 25 or 30 feet pillars. The result is that the upper storeys and chimney-pots are well lighted, but the footpaths and roadways, save in the immediate vicinity of the arc lamps, are just pale moonshine; and I quite agree with you that "it is spotty and ineffective at the best." The cost will, I dare say, be found out later on.

In your "Notes" in the same issue, in the one on "Distempers, Varnishes, and Enamels," you say: "It is stated that for coating rough out-of-door woodwork, palings, &c., a good and cheap composition can be made of equal parts of Stockholm tar and boiled linseed oil, heated and well stirred together." I think a still cheaper article, and a very serviceable one, from my experience, would be found in ordinary creosote. It is easily laid on, either hot or cold. Though rather darker than Stockholm tar, it throws up the grain of the wood, especially fir timber. I do not, for some purposes, believe in the pickling process, especially where the timber is exposed to the weather, such as in the case of the decking of a viaduct and the transverse beams or joists. These should be coated with creosote on the tops and sides, but left free to the air on the under side. My experience is that the life of the timber is very much prolonged. If these remarks should increase the sale of creosote, so much the better will it be for tar distillers, and it might indirectly increase the value of coal tar.

S. W. DURKIN.

Southampton, May 6, 1899.

Manufacturers and Corporation Trading.

SIR,—Traders throughout the country should feel grateful to the Committees of both Houses who have justly insisted upon striking out from all Gas Bills promoted by Local Authorities the clause which sought to give them powers to "manufacture, sell, and deal in all sorts of appliances required for the consumption of gas." They should, in my opinion, go still further, and make the same imperative in all Bills brought before them, whether by private companies, local authorities, or public corporations, which would interfere with the manufacturers and traders of the country.

Even now there are many gas companies, corporations, and local authorities throughout the country who have within the past few years erected spacious workshops, and who engage a large staff of hands in the repairs of gas meters and stoves, to the detriment of the manufacturers. Take, for example, the question of meters. It is well known that the manufacturers are bound to give a five years' guarantee for all ordinary new meters, and in some cases the same terms for repairs. Within this guarantee the maker gets his meters returned to him religiously for every trivial defect, which he has to make good at a loss. But directly the five years' guarantee has expired, and he expects to have these meters as repairs, they are instead sent into the company's or municipal workshops, as the case may be, and there repaired. Manufacturers and traders have only to look around, and they will find that every year larger workshops are being built, and this system of "repairs" extending within the walls of gas companies, corporations, &c.; and if they were once to get the power to "manufacture, sell, and deal in" all sorts of appliances, where would the manufacturers and traders find themselves? Now that a Parliamentary Committee are sitting to consider the question of the sale of gas, would it not be as well for them to ascertain whether these companies and public bodies have the power, under their Acts, to even "repair" gas-meters, which are the authorized legal "policeman" between them and the consumers?

While on the subject of gas-meters, is it fair towards the manufacturers, who within the past few years have expended a vast amount of patience, ingenuity, and capital in producing penny-in-the-slot meters and bringing them to their present stage of efficiency, that even an iota of the benefits accruing therefrom should be taken away by this system of companies and corporations doing their own repairs? Surely they should be satisfied with the great impetus which private enterprise has given to their industry, with its corresponding immense increase in their revenues, and allow the gas-meter makers to reap the full benefit of their labour, patience, and business capacity.

This I feel only touches the fringe of the vast and important question of manufacturers *v.* corporation trading; and it seems to me that great credit is due to the vigilance of our legislators, who have so wisely given the death-blow to a pernicious principle which would have inflicted considerable injustice and wrought no end of mischief upon the traders and manufacturers of this country.

LIVE AND LET LIVE.

May 4, 1899.

Darwen Corporation Gas and Water Undertakings.—At the monthly meeting of the Darwen Town Council last week, Alderman Davies presented his annual statement as to the working of the Gas Department. It showed that there had been a large increase in the gas consumption, due probably to the reduction in the price, and that there had been a considerable increase in the number of prepayment meters in use. The total result of the year's working gave a profit of £744, which was considered a satisfactory return. Alderman Davies said he had hoped that this year they would have another reduction; but, in view of the increase which had taken place in the price of coal, coupled with the fact that the assessment of the gas-works was going to be raised nearly £2000, he thought it better not to make any change. At the same meeting, Alderman Duxbury submitted his annual statement with regard to the water-works. The profits amounted to £242; this being earned after providing out of revenue account £273 for some necessary alterations to the filter-beds. The reports were adopted.

PARLIAMENTARY INTELLIGENCE.

Gleanings from the Committee Rooms.

By the time the Hastings and St. Leonards Gas Company's Bill came before the Lords Committee on Monday last week, the petitioners against it had dwindled down to one. This was a landowner—Mrs. Eversfield; and the weakness of her opposition is shown by the summary way in which the Committee rejected the representations made on her behalf, and passed the preamble of the Bill.

The Bill as laid before the Committee was shorn of one of its two most interesting features—that was the proposed amalgamation, by mutual agreement, of the Company with the Bexhill Water and Gas Company. Taking (with an intimate knowledge of the history of the two places) a prospective view, one can well divine many advantages which would accrue from the strength which would be produced by an amalgamation of these two concerns. On the other hand, one can also respect the desire of the Bexhill Company to remain in undisturbed possession of their tight little undertaking, with its fair prospects. Bexhill is not the sleepy little seaside resort of a few years ago. It is now full of life, is yearly becoming more popular, and for many years to come the builders are not likely to stay their incursions into the green fields surrounding the town. If they continue at the rate they are doing now, it will not be many years before they will unite Bexhill to Hastings; and then amalgamation of a more extensive order than that recently contemplated by the Hastings Gas Company may follow.

The sole opposition to the Bill last week was directed against the proposal of the Company to obtain a new site for their works at Glyne Gap. Certainly if there is one part of the Bill above all others which has been framed in the best interests of the town, it is this one; and therefore both the town and the Company are to be congratulated on its retention. The site of the present works has never been what could be called an ideal one; and as the town has grown, its unsuitableness has become more and more pronounced—being, as it is, almost within a stone's throw of the heart of the borough, and crowded with buildings and plant to its utmost capacity.

The Company asked for additional money powers, and the conversion of their shares into stock; and their other requirements were all of a useful and up-to-date character. The quickness with which the Bill was disposed of by their Lordships was almost, if not quite, phenomenal. Only Counsel were heard; and no witnesses were called, although Mr. C. E. Botley, the Company's Engineer, and other gentlemen were in attendance, and well primed for action, three or four days before the Bill was overtaken by the Committee.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bills brought from the Commons, read the first time, and referred to the examiners: Brigg Urban District Gas Bill, Shotley Bridge and Consett District Gas Bill.

Bills presented, read the first time, and referred to the Examiners: Gas Orders Confirmation Bills (Nos. 1 and 2), Gas and Water Orders Confirmation Bill, Water Orders Confirmation Bill.

Bill read a second time and committed: Ilford Gas Bill.

Bills reported: Broughty Ferry Gas and Paving Order Bill, Burley-in-Wharfedale Urban District Water Bill, Church Stretton Water Bill, Clay Cross Water Bill, Dundee Gas, Tramways, and Extension Bill, Gainsborough Urban District Council Gas Bill, Glasgow Corporation Gas and Water Bill, Great Yarmouth Water Bill, Hastings and St. Leonards Gas Bill, Horsforth Urban District Council Water Bill, Ilford Gas Bill, Leigh-on-Sea Urban District Council Bill, Rawtenstall Corporation Water Bill [preamble not proved], Stockton and Middlesbrough Water Bill.

Bills read the third time and passed: Barton-on-Sea Water Bill, Bury Corporation Bill, Broughty Ferry Gas and Paving Order Bill, Clay Cross Water Bill, Mid-Kent Gas Bill, Skipton Urban District Gas Bill, Southampton Corporation Water Bill.

The Metropolitan Water Companies [Government] Bill, the Loughborough Corporation Bill, and the Loughborough Gas Bill have been referred to a Select Committee, consisting of Lord Ribblesdale (Chairman), Viscount Falkland, Lord De Mauley, Lord Wrottesley, and Lord Newton; to meet on Friday, May 5.

The South Essex Water Bill and the Whitehaven Corporation Bill have been referred to a Select Committee, consisting of Lord Brougham and Vaux (Chairman), Viscount Gordon, the Earl of Denbigh, the Earl of Yarborough, and Lord Calthorpe; to meet on Tuesday, May 9.

HOUSE OF COMMONS.

The following further progress has been made with Bills:—

Bills read the first time and referred to the Examiners: Barton-on-Sea Water Bill (Lords), Broughty Ferry Gas and Paving Order Bill (Lords), Bury Corporation Bill (Lords), Mid-Kent Gas Bill (Lords), Skipton Urban District Gas Bill (Lords), Southampton Corporation Water Bill (Lords).

Bills read a second time and committed; Arbroath Corporation Gas Bill (Lords), Cambridge University and Town Gas Bill (Lords), Dumbarton Burgh Bill (Lords), Glastonbury Water Bill.

Bills reported: Belfast Water Bill, Birmingham Corporation Bill, East London Water Bill, East London Water (Temporary Supply) Bill, West Middlesex Water Bill.

Bills read the third time and passed: Herne Bay Water Bill (Lords), Scunthorpe Urban District Gas and Water Bill, Shotley Bridge and Consett Gas Bill, Walton-on-Thames and Weybridge Gas Bill.

The Bristol Gas Bill, Lea Bridge Gas Bill (Lords), Walker and Wallsend Gas (Electric Lighting) Bill, Woking Water and Gas Bill, and Yeadon and Guiseley Gas Bill have been referred to a Select Committee, consisting of Sir Henry Fletcher (Chairman), Sir Leonard Lyell, Mr. R. F. Cavendish, and Mr. Rickett; to meet on Tuesday, May 9.

HOUSE OF COMMONS SELECT COMMITTEE.

Thursday, May 4.

(*Sir* James Rankin, *Chairman.*)

THE POWERS OF CHARGE OF THE METROPOLITAN GAS COMPANIES.

The Select Committee resumed to-day their inquiry into the above subject; the first witness called being

Mr. Charles Hunt, M.Inst.C.E., *of Birmingham.*

Witness said he appeared by request of the London County Council. He was a Past-President of the Institution of Gas Engineers, formerly Assistant-Engineer to the late London Gaslight Company, and afterwards Chief Engineer to the late Birmingham Gas Company. He was, and had been since 1875, Chief Engineer at the Windsor Street and Adderley Street Gas-Works. He was acquainted with the legislation and also with the general conditions affecting the gas supply of London. The price charged by The Gaslight and Coke Company north of the Thames compared unfavourably with that which was charged for the gas of any other important undertaking, whether Metropolitan, Suburban, or Provincial. He had added to his notes an appendix giving the prices charged in various places, and was not sure that it was not a repetition of what had been already given. In only one or two cases was the price of 3s. per 1000 cubic feet of The Gaslight and Coke Company equalled; and in these the carbonization did not exceed about 1-20th of that of The Gaslight and Coke Company. This price of 3s. is greatly in excess of what is charged by any of the leading Provincial gas undertakings. It is true that the circumstances of these undertakings differ in some respects from those of The Gaslight and Coke Company. For instance, in the Midland districts, coal is usually obtained at a cheaper rate than in London. This, in some cases, as in Liverpool and Manchester, enables gas to be supplied of a substantially higher illuminating power than that which is furnished by the Metropolitan Companies.

The Chairman: Where does the coal for London gas come from?

Witness: From the North. The Gaslight and Coke Company get theirs from Newcastle by water to Beckton. In other places, as at Birmingham and Leicester, the illuminating power of the gas is not materially higher than in London, but advantage is given to the consumer in regard to price—that is to say, a comparatively low price is regarded as of more value to the consumer than an extra high quality of gas. Cheap coal, however, is synonymous with cheap coke. Coke fetches a much higher price in London than it does in the nearer neighbourhood of the coal-fields. London is also a shipping port for coal tar and ammonia products, for which railway carriage has to be paid from gas-works in the Midlands. On the whole, therefore, more is obtained for residuals in London than is usually obtained elsewhere; and this quite compensates for any higher price that may have to be paid for coal. This statement is supported by figures taken from "Field's Analysis" for 1897 (the latest complete return), which shows the cost of coal, less residuals, per 1000 cubic feet sold by some of the principal gas undertakings. The figures are: The Gaslight and Coke Company, 6·54d.; Commercial Gas Company, 7·78d.; South Metropolitan Gas Company, 5·46d.; Birmingham, 7·32d.; Leicester, 6·51d.; Manchester, 8·93d.; Nottingham, 5·14d.; Brighton, 8·27d.; Bristol, 6·47d.; Derby, 7·06d.; Liverpool, 11·55d.; Plymouth, 9·06d.; Portsea, 8·27d.

The Chairman: According to this list of figures, coal is as dear in the Midlands as it is in London?

Witness: Yes.

The Chairman: London is not unfavourably situated as to the price of coal?

Witness: Certainly not, if residuals are taken into account. The figures given show that the two principal Metropolitan undertakings have an advantage over most of the Provincial ones in the list. The cost of labour is usually somewhat less in the Provinces than in London, although, speaking from what I know of Birmingham, the tendency in large towns is towards an assimilation of rates with those of London. Within the last few months, gas stokers' wages in London have been advanced 5d. per shift of eight hours. Previous to this advance, our highest rate of 5s. 9d. was 2d. higher than the ordinary highest rate of 5s. 7d. paid in London.

The Chairman: Then they are highly paid labourers?

Witness: Yes; they work 6½ days at eight hours a day. Some work at night, they have three shifts a day. The most useful comparison is, however, between the London Companies themselves, because all of them are working under exactly the same conditions as to illuminating power and purity, they all obtain their coal from practically the same source, have the same market for their residuals, and occupy geographically almost similar positions. I am speaking of the two principal London Gas Companies. The Gaslight and Coke Company make about one-half of their gas at the Beckton works, where there are facilities for manufacture which are second to none; the other half being distributed among nine or ten smaller works, most of them situated away from the river. One large works is on the south side of the river, at Nine Elms; and coal is delivered there in special steamers without transhipment.

The Chairman: Being away from the river means a disadvantage?

Witness: Well, if they are not on the river they are on a canal. The South Metropolitan Company's largest works are at East Greenwich, also some way down the river, but nearer than Beckton to the district that is supplied. With one important exception—that of Old Kent Road—the other works of this Company are situated upon the river. The delivery of coal to works which are situated away from the river, necessitates canal lighterage. This, with the South Metropolitan Company, is involved at the Old Kent Road works, which are of large size. Having regard to this on the one hand, and on the other to the advantage of cheap delivery to the Nine Elms works, it does not seem possible that the average cost of delivery of coal can be substantially greater to The Gaslight and Coke than to the South Metropolitan Company.

The Chairman: Do I understand you to say that, as the result of your observation on this point, there can be very little in it?

Witness: Yes. It is objected to as a disadvantage by The Gaslight and Coke Company, that the Gas Referees have prescribed more testing-places for the Company, and at a very much greater distance from the works, than they have done in the case of the South Metropolitan Gas

Company. The number of testing-places prescribed for TheGaslight and Coke Company's gas is fifteen; and for that of the South Metropolitan Company, six. These numbers, divided into the average daily sale of gas by each Company, give one testing-place for every 3·8 millions in the case of The Gaslight and Coke Company, and one for every 4·2 millions in that of the South Metropolitan Company. From this point of view, there is no very decided advantage in favour of the South Metropolitan Company. It is, however, objected that some of the testing-places of The Gaslight and Coke Company are at a distance of 10 or 10½ miles from the works; whereas in the case of the South Metropolitan Company, the greatest distance of any testing-station from the works is 3½ miles. This objection rests upon the assumption that gas loses in illuminating power according to the distance it has to travel; and it is supposed to account for a greater proportion of enriching materials used by The Gaslight and Coke Company than by the South Metropolitan Company. My own observation leads me to believe that gas does lose a little of its illuminating power on its way to the consumers; but also that this loss occurs generally at a comparatively short distance from the works, and when the gas undergoes an alteration of temperature in the mains. So far, however, as I am aware, there are only two records of authoritative experiments upon this subject. One is that of experiments made by the then Gas Referees in 1870-1, on the gas sent from Beckton to the Brick Lane station of the Chartered Company as it then was, a distance of about 9 miles; the result arrived at being that the illuminating power of the gas did not appreciably suffer from the great distance it had to travel. A copy of the report of the Referees to the Board of Trade on this subject can be produced. [Witness proceeded to read extracts from the report.] The other record is one of experiment made by Mr. J. B. Paddon, who was Engineer to the Brighton and Hove Gas Company, and is now a Director of The Gaslight and Coke Company. It was published in "King's Treatise on Coal Gas" in 1879; and the conclusion arrived at was that the gas, after travelling 10 miles, lost little more than 3 per cent. of its illuminating power. A copy of the statement as published can be produced. Enrichment, however, is stated to cost The Gaslight and Coke Company 0·85d. per 1000 cubic feet sold more than it does the South Metropolitan Company. Enrichment is effected either by the use of cannel, carburene spirit, or carburetted water gas. The two first-named materials add to the cost of the gas, being of themselves somewhat expensive; but carburetted water gas has for the last year or two been actually cheaper to manufacture, light for light, than coal gas. It has, in fact, been produced in considerable quantities largely on this account, in addition to the facility with which it is manufactured. In Birmingham, the cost of carburetted water gas has, during the last two winters, been less than that of coal gas by about 1½d. per 1000 cubic feet, and for a higher quality of gas. About two-thirds of the gas made by The Gaslight and Coke Company is stated to be enriched with carburetted water gas, and only one-third with the actually more expensive cannel or carburene spirit.

In answer to a question by the Chairman as to the manufacture of water gas, witness explained the process. He said he could not give any reason why this system was not adopted by the South Metropolitan Company, except that Mr. Livesey did not approve of it. So long as they could make cheap gas as at present, Mr. Livesey was disinclined to resort to it. There could be no doubt that water gas was cheaper to manufacture than coal gas. He went on to say: It is well known that the South Metropolitan Company are dependent entirely upon cannel and carburene spirit for their enrichment—not having any carburetted water-gas plant. It does not, therefore, appear that The Gaslight and Coke Company are entitled to consideration, either on the ground of special necessity for enrichment or of extra cost of the same. A further disadvantage to The Gaslight and Coke Company is stated to be that their greatest daily output in midwinter is a higher percentage of the annual output than in the case of the South Metropolitan Company. The proportions for 1897 were $\frac{1}{184}$th and $\frac{1}{167}$th respectively. This greater disproportion means an extra amount of manufacturing plant to be provided in order to meet the maximum demand, or else increased storage. The value of this excess plant over that which the South Metropolitan Company find to be sufficient, is put by The Gaslight and Coke Company at £400,000—that is to say, this amount of capital is needed by The Gaslight and Coke Company in excess of what is required by the South Metropolitan Company to enable them to cope with this excessive demand. This excess was, however, greater a few years ago than it is at the present time; the figures being $\frac{1}{180}$th, $\frac{1}{167}$th, and $\frac{1}{179}$th for 1888, 1889, and 1890. The position of the Company in this respect has consequently improved during the last ten years. Any excess plant that may have had to be provided on this account must, moreover, have been in existence prior to 1888, and has, therefore, favourably affected the working of subsequent years, because the necessity for it was gradually lessening, and a portion of it would be rendered available to meet the ordinary consumption. In addition to this, carburetted water-gas plant must have largely taken the place of coal-gas plant for the purpose of meeting sudden emergencies; this being one of the merits of the system. Carburetted water-gas plant can be started in full work in 4 or 5 hours; whereas coal-gas plant requires not less than 36 hours to start it. Turning to the differential charge made to consumers of The Gaslight and Coke Company south of the Thames, in accordance with the terms of the amalgamation with the London Company in 1883, I would point out that this adds, at the present time, more than 1d. per 1000 cubic feet to the price to consumers on the north side. It could not have been anticipated that there would at any time be so great a difference as now exists between the charges for gas north and south of the Thames, or such terms would hardly have been agreed upon. Onerous as these terms have proved to be, they have been made still more so by the action of The Gaslight and Coke Company in abolishing meter-rents, by which the price to their consumers south of the Thames is actually lower by about ¾d. per 1000 cubic feet than the price of the South Metropolitan Company, who continue to charge meter-rents. A way out of the present difficulty appears to be a transfer on equitable terms of the districts south of the Thames to the South Metropolitan Company, either with or without the works at Nine Elms, from which the districts are at present supplied.

The Chairman: The Gaslight and Coke Company charge more on the north side of the Thames than on the south?

Witness: They are obliged to do that to meet their obligations on the south side. The South Metropolitan Company can make gas cheaper than The Gaslight and Coke Company. The other causes which, in my opinion, have mainly contributed to the exceptionally higher price now charged by The Gaslight and Coke Company north of the Thames (and which have all operated during the last ten years) are as follows: (1) An undue expenditure on capital account; (2) a reduction in the rate of increase of ordinary gas consumed, as distinguished from prepayment meter consumption—that is to say, the slot system; and (3) an increase in the cost for coal and working expenses. As to the undue expenditure on capital, the capital expenditure of the Company in 1876, when they were put under the provisions of the sliding-scale and auction clauses, stood at the high figure of £855 per million cubic feet of gas sold during the year. In the year 1882, and prior to the amalgamation with the London Company, the capital had been reduced to £762 per million cubic feet sold. In that year, the capital of the London Company stood at only £567 per million cubic feet sold; and their capital charges were only 10·05d. per 1000 cubic feet sold, as compared with 16·83d. in the case of The Gaslight and Coke Company. This amalgamation, therefore, was eminently favourable to The Gaslight and Coke Company; and the effect of it was at once apparent in the reduction of their charges for capital from 16·83d. to 15·58d. per 1000 cubic feet sold. During the succeeding years, and until 1888, the capital of the Company continued to show a reduction per million cubic feet sold; and in that year it was actually less in amount than in 1883—the figures being: 1883, £10,732,629; and 1888, £10,690,900—though in the interval the consumption of gas had increased by 2463 million cubic feet. This actual reduction was brought about in part by a system of depreciation of plant, meters, and stoves, which, however, only continued for a short time, and has entirely disappeared for the last three years. In 1885, as much as £76,868, and in the following year £39,391, was written off. In 1887, the amount was reduced to £19,985; and in 1888, to £11,025. For some time longer meters and stoves continued to be depreciated at a reduced rate. These amounts include some small sums for land resold. During the last three years, nothing has been written off.

The Chairman: Do you wish to found any argument on the fact that depreciation has ceased?

Witness: No; except that I claim this as partly the reason why the capital was at a lower amount in 1888 than in 1883.

The Chairman: Instead of writing off depreciation, they had been doing work in addition to ordinary repairs?

Witness: Yes. The capital stood in 1888 at only £618 per million cubic feet sold. At the present time, it stands at £646, which is an increase in the ten years of £26 per million. If taken over a longer period—say, from 1876 or 1883 to the present time—the capital expenditure will not show so unfavourably. Since 1883, it has been reduced from £724 to £646 per million; and the actual increase, if spread over this period, works out at £458. As, however, there was no substantial expenditure on capital account from 1883 to 1888, it is clear that, prior to 1883, very ample provision must have been made for the increase of the succeeding years. No such provision exists to-day as is proved by the Bill now before Parliament for granting the Company further powers for extensions, and as stated in support of the Bill. The period, therefore, down to 1888 requires to be considered separately from that which followed it. In 1888, apparently, the productive capacity of the works had become exhausted, and capital expenditure began afresh. This, at any rate, seems to be a reasonable explanation of the increase of capital expenditure from £28,000 in 1887 to £84,000 in 1888. Since 1888, the capital expenditure has constantly and greatly exceeded that which is ordinarily regarded as sufficient, and which has been found to be so in respect of other gas undertakings. The general experience in connection with gas undertakings is that the capital expenditure becomes proportionately less as the business increases; and this was the experience of the Company down to 1888. The reason for this is that large plant usually costs less in proportion to its capacity than smaller plant, and also that in some directions cheaper methods of construction are now followed than formerly. Expenditure is also incurred in laying out entirely new works which does not recur when the works have merely to be extended from time to time. About £600 per million cubic feet sold in the year is usually considered a fair allowance for the establishment of an undertaking with new works and distributing plant. According to my experience, from £300 to £400 per million cubic feet sold during the year is sufficient to provide for the increase of business, where such provision can be made upon a fairly large scale. This is substantially confirmed by the estimate of £392 per million cubic feet sold, which has been put forward in support of the Bill now before Parliament, and which is entirely for coal-gas plant; no provision for additional carburetted water-gas plant being included. The latter costs much less than coal-gas plant. In some years, the capital expenditure may be greater than in others, owing to the necessity for anticipating to some extent the requirements of the near future. A period of ten years should cover all such fluctuations of expenditure. In this case, the necessity for expenditure during the last ten years appears to have been of quite a normal character; nothing unusual in the shape of entirely new works having been required. Moreover, a considerable proportion of the additional productive capacity recently required has been met by the provision of carburetted water-gas plant. During this period of ten years the business of the Company increased by about 21 per cent.; but the proportionate capital expenditure not only was not diminished, but was actually increased. At the end of 1898, the capital of the Company (including the amount of a temporary loan of £450,000) stood at £13,555,000. This, compared with the amount for 1888—namely, £10,690,900—represents an increase of £2,864,900. The actual increase in the sale of gas during the same period was 3689 million cubic feet. The capital expenditure was, therefore, at the rate of £776 per million cubic feet. Excluding the amount of the temporary loan (which has since been partly replaced by an issue of fresh capital), it works out at the rate of £654 per million cubic feet of gas sold. Compared with the Company's own estimate of £392, these figures show an excess expenditure, with or without the loan, of £384 and £262 per million cubic feet respectively. Reckoned at only £262 per million, this excess expenditure represents a capital sum of £966,518. The Company may fairly be asked to account for this extra expenditure—especially having regard to the assistance they received from the lower cost of carburetted water-gas plant—and which is so much at variance with their estimated requirements for the next ten or twelve years. The South Metropolitan Gas Company expended on capital account (including the

prepayment meters, in greater proportion than The Gaslight and Coke Company) during the same period an average of only £343 per million cubic feet of gas sold, including the amount of a temporary loan of £100,000.

The CHAIRMAN: You wish us to compare the £343 with the £776?

Witness: Yes. The difference between the capital expenditure of The Gaslight and Coke Company and that of the South Metropolitan Company represents, on the total increase of the first-named Company during the ten years (3689 millions), a capital sum of £1,567,000. The interest upon this would amount, at 4 per cent., to £62,680 per annum, or nearly ¾d. per 1000 cubic feet upon an annual sale of about 21,000 millions. As to the second cause which has led to exceptionally high price—viz., a reduction in the rate of increase of ordinary as distinguished from prepayment meter consumption—I would say the quantity of gas sold by The Gaslight and Coke Company in 1876 was 9472 million cubic feet. In the year 1883, when the Company took over the undertaking of the London Gaslight Company, the gas sold by the two Companies was 14,825 million cubic feet. This in 1888 had risen to 17,288 millions; being an increase in the five years of 16·6 per cent. The progress made by the Company since 1888 down to the present time is shown by the following figures, giving the quantity of gas sold in millions of cubic feet: In 1888, 17,288; in 1889, 18,105; in 1890, 18,536; in 1891, 19,233; in 1892, 19,117; in 1893, 18,244; in 1894, 18,244; in 1895, 19,295; in 1896, 20,116; in 1897, 21,023; in 1898, 20,977. The table shows that down to, and including, the year 1891, the increase previously observable still continued.

Mr. COHEN: The competition with the electric light has been more fierce in the district of The Gaslight and Coke Company than in that of the South Metropolitan Company, has it not?

Witness: Yes. From 1891 to 1894 there was an actual decrease in the consumption; but from 1894 onwards there was again an increase. As to the latter, it is of importance to note that the prepayment meter system was introduced by the Company in 1894-5. The introduction of this system has materially influenced the sale of gas during the past few years. In 1898, the gas supplied to prepayment meter consumers is stated to have amounted to about 1500 million cubic feet. Deducting this from the total sales for the year, leaves as sold to ordinary consumers and for public lighting 19,477 million cubic feet. This is but little in excess of the total consumption in 1891—or seven years previously, and before the introduction of the prepayment meter system—when it amounted to 19,233 million cubic feet. It appears from this that the amount of gas sold to ordinary consumers no longer shows its former elasticity, and that the Company are now largely dependent upon the extension of the prepayment meter system for any increase. The comparatively small increase in the sale of gas to ordinary consumers has prevented, and should have prevented to a greater extent than was actually the case, the introduction of fresh capital at a lower rate of interest under the operation of the auction clauses. Though, therefore, the capital charges of the undertaking have been from time to time reduced, this reduction has proceeded more slowly than in the case of the South Metropolitan Company, with their much greater rate of increase of gas consumption, but with a larger proportion of prepayment meters to provide for. In the case of the last-named Company, the increase of consumption from 1888 to 1898 was nearly 67 per cent., as compared with about 21 per cent. in that of The Gaslight and Coke Company. The capital charges of The Gaslight and Coke Company in 1883 amounted to 15·58d. per 1000 cubic feet sold; and they now stand at about 12¾d.—showing a reduction in the fifteen years of about 2¾d. per 1000 cubic feet sold. The capital charges of the South Metropolitan Company in 1883 were 14·24d. per 1000 cubic feet sold; whereas they now stand at 9·18d.—showing a reduction in the fifteen years of 5·06d. per 1000 cubic feet sold. The difference between the capital charges of the two undertakings—which in 1883 was 1·34d., and in 1888 1·87d.—now amounts to more than 3½d. per 1000 cubic feet sold, in favour of the South Metropolitan Company. This increased difference has accrued for the most part during the last few years. It is to be accounted for partly by a lower rate of capital expenditure, and partly by the introduction of a larger proportion of fresh capital at lower interest in the one case than in the other. The prepayment-meter system, though contributing so largely to the consumption during recent years, does not appear to have proved so advantageous to The Gaslight and Coke Company as to the South Metropolitan Company. The latter Company, though less than one-half the size of the other, have about 80,000 prepayment meters in use, as compared with about 100,000 now in use by The Gaslight and Coke Company. Their accumulated charge for gas-fittings in connection with the system amounts to only £26,633, as compared with nearly £300,000 in the case of The Gaslight and Coke Company. This points either to a lower charge made for gas supplied to automatic meter consumers, or to a higher rate of expenditure upon the fittings by The Gaslight and Coke Company than by the South Metropolitan Company. Be this as it may, this large outstanding debt of £300,000 affects the amount of floating capital which is required to work the undertaking, and upon which interest has to be paid by the ordinary consumers, who derive no direct benefit from any such extraordinary expenditure. Coming to the increase in the cost of coal and working expenses, it is, as shown by the tables, both actual and comparative. The year 1888 has been taken for comparison with last year, both because it was the starting point of the period of ten years already referred to, and also because during the previous years rather large amounts were taken out of revenue for the reduction of capital—to this extent abnormally increasing the working expenses. This is favourable to The Gaslight and Coke Company, because in 1888 they were making a small quantity of cannel gas, which in that year increased the cost of manufacture. Apart from rates and taxes, which have increased by 0·48d. per 1000 cubic feet, the total increase in working expenses since 1888 has been 3·13d. per 1000 cubic feet; whereas the increase in the case of the South Metropolitan Company has only been 1·42d. per 1000 cubic feet, or including profit-sharing 1·97d. per 1000 cubic feet. The difference between the two Companies—which in 1888 was 1·29d.—is now 2·45d. per 1000 cubic feet, *ex* rates and taxes. For rates and taxes, the difference between the two Companies has increased since 1888 from 0·58d. to 1·13d. per 1000 cubic feet sold. The amount set down for coal in both cases includes the cost of cannel, oil used in the making carburetted water gas, and carburine spirit. The cost for carbonizing wages is practically the same for cannel as for common coal; the yield of gas being somewhat greater. Carburine spirit raises the illuminating power of the gas without appreciably increasing its bulk. Carburetted water gas, on the other hand, is made in bulk to the extent of from one-sixth to one-third of the total quantity of gas manufactured. Oil forms by far the largest proportion of the cost of carburetted water gas; labour being only a comparatively small item. Where, therefore, carburetted water gas is made in any considerable quantity, one would expect to find a fractionally higher expenditure set down for coal, less residuals, and a comparatively low one for carbonizing wages. In this Company's accounts, there is more than a fractionally higher expenditure for coal, which last year cost them 1·62d. per 1000 cubic feet more than it did the South Metropolitan Company. There is no corresponding diminution under the head of carbonizing wages. The difference between the two Companies as to the latter was in 1888 only 0·07d. per 1000 cubic feet sold in favour of the South Metropolitan Company; whereas last year it showed an increase to 1·29d., or, if two-thirds of the cost of profit-sharing be added to the South Metropolitan figure, 0·92d. per 1000 cubic feet sold, notwithstanding the assistance afforded to The Gaslight and Coke Company by the large quantity of carburetted water gas they manufacture.

The CHAIRMAN: I see the wages of The Gaslight and Coke Company have risen during the past few years, while those of the South Metropolitan Company have gone down?

Witness: That is so. This increased difference is largely due to the South Metropolitan Company having adopted machinery in the retort-house to a great extent during the last few years, whereas The Gaslight and Coke Company have done comparatively little towards the abolition of hand labour. In this respect they are behind the times. During the last few years, machinery has been brought into use, not only at the South Metropolitan works, but more or less at nearly all gas-works of any importance. Among other examples may be quoted the following:—

	Carbonizing Wages, per 1000 Cubic Feet Sold.
Brentford	2·37*
Bromley	2·62†
Birmingham	2·92
Manchester	2·81

*Inclined Retorts. †Higher wages for 12-hour shift.

I am of opinion that it should be possible to save fully 1d. per 1000 cubic feet sold on this item alone.

The CHAIRMAN: Do you consider that the new machinery you speak of would displace the old?

Witness: Not to a great extent. With regard to residuals, it is difficult to understand why The Gaslight and Coke Company should not realize as much for their coke and breeze as the South Metropolitan Company. The Beckton coke is most, if not all of it, sold wholesale; but so also is a large quantity of the production of the South Metropolitan Company, and both appear to have equal advantages as to a retail market. The net prices per ton obtained by each Company for coke and breeze last year were: The Gaslight and Coke Company, 9s. 5·3d.; the South Metropolitan Company, 11s. 0·3d.—showing a difference in favour of the South Metropolitan Company of 1s. 7d. per ton. Nearly 5d. per ton of this advantage was due to the lower cost for labour in the case of the South Metropolitan Company; the figures being: The Gaslight and Coke Company, 1s. 10d.; and the South Metropolitan Company, 1s. 5·3d. The net result is that coal, less coke and breeze, cost this Company 2·08d. per 1000 cubic feet sold more than it did the South Metropolitan Company; the following being the figures:

	Gaslight and Coke Company.		South Metropolitan Company.
Coal	14·24d.	..	13·39d.
Less coke and breeze	5·56d.	..	6·79d.
Net cost	8·68d.	..	6·60d.

Tar and ammoniacal liquor both realize more with The Gaslight and Coke Company than with the South Metropolitan Company. The Gaslight and Coke Company, although having a tar distillery which should enable them to secure the profit which usually goes to the distiller, obtain less for their tar than does the Commercial Company by selling it under a sliding-scale of prices. Deducting in each case the amounts received for tar and ammoniacal liquor, the net advantage in favour of the South Metropolitan Company in the cost of coal less residuals on last year's working was 1·62d. per 1000 cubic feet sold. This compares with a difference of 1·39d. per 1000 cubic feet sold in favour of the same Company in 1888. As to distribution charges these compare thus:

	Cost per 1000 Cubic Feet sold. 1888.	1898.
Gaslight and Coke Company	1·73d.	2·99d.
South Metropolitan Company	1·88d.	2·63d.

It will be seen that, instead of a difference against the South Metropolitan Company of 0·15d. per 1000 cubic feet of gas sold in 1888, there is now a difference in favour of that Company of 0·36d. As compared with The Gaslight and Coke Company the South Metropolitan Company have since 1888 improved their position, as regards cost of distribution, by 0·51d. per 1000 cubic feet sold. The actual increase in the case of the South Metropolitan Company has been considerable, but is largely to be accounted for by an increase in the cost of repairs to stoves, of which much greater numbers are now in use than formerly. This also applies to The Gaslight and Coke Company; but in their case the increase has been much greater, as is shown by the following figures: In the year 1898, the cost per 1000 cubic feet sold was 2·99d.; in 1897, 2·93d.; in 1896, 2·95d.; in 1895, 3·18d.; in 1894, 2·56d.; in 1893, 2·44d.; in 1892, 2·30d.; in 1891, 2·31d.; in 1890, 2·29d.; in 1889, 1·97d.; in 1888, 1·73d. The increase in 1895 and the succeeding years corresponds with the introduction of the prepayment-meter system, and may be attributable in some way to it. In so far as it represents an increase in the cost of repairing stoves, it is to a great extent returned by the rents received for the latter. In this respect, however, the South Metropolitan Company appear to do better than the other Company, for they made a profit last year of nearly £3000 after deducting cost of repairs; whereas the other Company made a loss of over £16,000. I fail to see any reason why the distribution charges should show such a tendency to increase; my experience being that, with a larger quantity of gas to distribute, the tendency is in the other

direction. In Birmingham, for example, the following has been the cost per 1000 cubic feet for distribution for each year since 1887: For 1898, not yet known; 1897, 1·77d.; 1896, 1·88d.; 1895, 2·04d.; 1894, 1·85d.; 1893, 2·22d.; 1892, 1·99d.; 1891, 2·09d.; 1890, 2·19d.; 1889, 1·90d.; 1888, 2·08d. In my opinion, it should be possible to reduce the cost of distribution by about ½d. per 1000 cubic feet. To summarize my statement, I may say that down to the year 1888 there does not appear to be anything of material importance to urge against the management of the affairs of The Gaslight and Coke Company, though the consumers derived no benefit from the amalgamation with the London Company. In that year, the difference between the price charged by the Company north of the Thames and that charged by the South Metropolitan Company, was 4d. per 1000 cubic feet. This is substantially the same as existed in 1876 between the charge and the average charge made by the three Gas Companies south of the Thames—namely, the Phœnix, the South Metropolitan, and the Surrey Consumers' Companies, who afterwards became amalgamated, and formed the present South Metropolitan Company. In that year (1885), also, the difference between the cost of manufacture of the two Companies was 1·29d., or, including rates, &c., 1·87d. per 1000 cubic feet in favour of the South Metropolitan Company; while the difference in the capital charge in favour of the latter Company was also 1·87d. per 1000 cubic feet sold. It is chiefly since 1888 that the management of the Company appears to be seriously open to criticism. During the last ten years, the difference against the Company, as compared with the South Metropolitan Company, has increased as follows:—

	Per 1000 Cubic Feet Sold.
Increase in working charges	1·16d.
„ „ rates and taxes	0·55
„ „ capital charges	1·71
	3·42d.
Add probable cost of differential charge south of the river	1·00
„ abolition of meter-rents (say)	0·75
Total	5·17d.

which is substantially the increased difference in the prices charged last year by the two Companies, as compared with the prices charged in 1888. All the disadvantages under which it has been claimed that The Gaslight and Coke Company are under as compared with the South Metropolitan Company existed prior to 1888. In so far as these are actual disadvantages, the position of the Company has improved since that year. Having regard, on the one hand, to the lower cost of carburetted water gas, and, on the other, to the slight advantage possessed by the South Metropolitan Company in the retention of the twelve-hour shift at some of their works, there does not appear to be any reason why coal, less coke, and carbonizing wages should cost this Company more than they do the South Metropolitan Company. The difference in the cost of these items, including the whole cost of profit-sharing, is 2·82d. per 1000 cubic feet sold in favour of the South Metropolitan Company. Adding to this ½d. per 1000 cubic feet sold, the saving in distribution, makes a total possible saving of 3·32d. per 1000 cubic feet to be effected, as compared with the South Metropolitan Company. In addition, there should speedily accrue a saving in capital charges as the result of a reduction in the rate of capital expenditure.

By Mr. COHEN: There had been an undue expenditure of capital by The Gaslight and Coke Company. If his view was correct that they had been spending more than they ought, this would be a reason why he should not expect them to raise so much money by the Bill now before Parliament. The South Metropolitan Company had resorted more to stoking machinery than The Gaslight and Coke Company; machinery having been erected during the past ten years. One would have expected that the amount of capital spent by The Gaslight and Coke Company would have been proportionately less than that spent by the South Metropolitan Company. The South Metropolitan Company were in a better position with a smaller capital outlay. He had no doubt that the high price of gas north of the Thames had been a factor in encouraging the electric lighting competition.

By Mr. NICOL: If the consumers of The Gaslight and Coke Company south of the Thames were transferred to the South Metropolitan Company, they would pay the same price that the South Metropolitan Company were charging. Supposing the area were broken off from The Gaslight and Coke Company, no matter who took it over, it would enable the former Company to supply their consumers north of the Thames at a less charge than they did at present.

By the CHAIRMAN: He believed that some of the new capital which The Gaslight and Coke Company were seeking power to raise would be spent on labour-saving plant.

Mr. *Joseph Trenner* was next called.

He was a delegate from the Holborn Town Hall conference of Local Authorities, and described the attitude of the public on the north side of the Thames in regard to the charges of The Gaslight and Coke Company. He read the resolutions passed at public meetings, and dwelt upon these and upon the protests of the Local Authorities. He declared that agitation in the matter had calmed down when a reduction had been made in the price of gas; and that it had broken out afresh when the price was raised. As an instance of the impetus which high gas charges had given electric lighting, he said that when, in 1894, the price of gas was raised, the Holborn Board of Works decided upon an electric light installation, which had continued ever since. The success of electricity in this neighbourhood was due in part to the resentment of the gas consumers. He desired to see one uniform price for gas throughout London. Manufacturers who used gas-engines on the north side of the Thames had lately lost money, because they could not compete with manufacturers on the south side. The latter could produce articles at a less cost owing to the price of gas.

The Committee then adjourned.

We learn that the number of exhibitors in the Smoke Abatement Section of the Building Trades Exhibition at the Agricultural Hall, which closed last Saturday, was not sufficient to warrant the Committee in awarding the gold and silver medals; but they commended the "Quaker" coke-burning grate devised by Messrs. Webber and Price, which was described in the "JOURNAL" a fortnight ago (p. 1038).

HOUSE OF LORDS COMMITTEE.

(*Before Lord* LOCH, *Chairman*, *Lord* COLCHESTER, *Earl* CARNWORTH, *the Earl of* ROMNEY, *and Lord* WANDSWORTH.)

HASTINGS AND ST. LEONARDS GAS BILL.

This Bill, which is to give power to raise additional capital and to authorize the transfer of the Hastings and St. Leonards Gas Company's works to Glyne Gap, Bexhill, came before the above-named Committee on Monday of last week.

Mr. E. BOYLE, Q.C., and Mr. SHAKESPEARE represented the promoters; while Mr. BALFOUR BROWNE, Q.C., and Mr. SOPER appeared on the petition of Mrs. J. Eversfield and Mr. E. M. Bethune.

In opening the case for the promoters, Mr. Boyle said the Company was formed in 1832, and was registered shortly afterwards as the Hastings and St. Leonards Gaslight and Coke Company. The original capital was only £16,500; the population at that time being 10,800. The population increased; and in 1854, to meet the consequent increased demands, the Company applied to Parliament for incorporation and additional capital. In that year the capital was fixed at £41,350, with £13,750 of debentures, all of which was entitled to 10 per cent.; the maximum price of gas being 5s. 6d. per 1000 cubic feet. There was no restriction as to public lighting, except that the charge must be the lowest at which any private consumer was supplied. No illuminating power for the gas was prescribed. In 1865, further capital powers were obtained; the dividend, however, being reduced from 10 to 7 per cent., and the maximum price to 5s. per 1000 cubic feet. The gas, under this Act, was to be of not less than 14-candle power; and the Company were bound to erect a testing-station for the Town Council, who had always very carefully looked after the Company. In 1883, the population having largely increased, further capital powers of £150,000, with £30,000 of debentures, were obtained; and the sliding-scale was put upon the Company. At that time the population of Hastings numbered 48,000. In 1897, the Corporation extended their boundaries, with the result that the population now consisted of 80,000 persons. This number, however, did not include all the Company dealt with, because they supplied various districts outside the borough. The present Bill was for power to raise additional capital, and to borrow, as debentures, one-third of the capital authorized, instead of the usual quarter; also to allow the Company to purchase a new site for the gas-works at Glyne Gap, Bexhill. This site was 14½ acres in extent; and it was intended to remove all the manufacturing plant there, and to sell such portions of the old site as were not required. Power was originally taken to purchase the Bexhill Gas and Water Company; but the Company objected, and this portion of the Bill would therefore not be proceeded with. The present site, which was fully occupied, was in the centre of Hastings, and was surrounded by buildings of all sorts and descriptions. The new site was quite in the country—almost in a wilderness, because there were no buildings near it. The present works were only capable of supplying 2 million cubic feet daily. The Company found difficulty in keeping pace with the growth of the district; and it was therefore absolutely necessary that they should make some change. They might have gone for a Bill to extend their present works; but as this would have been disadvantageous to the town, they had gone to the proposed site, where the land was low—which he understood was an advantage for a gas-works. Further, it adjoined the London, Brighton, and South Coast Railway; and they would have therefore the additional advantage of a siding from the line. The site was also large enough to provide for all reasonable increase. The only petition was that of Mrs. Eversfield, the tenant for life of land adjoining the proposed site; but Counsel submitted that she had no *locus standi*, there being no house on the site, or within 300 yards of it, as the Standing Orders of both Houses of Parliament required before *locus* could be obtained. A considerable portion of the land represented by Mr. Soper was under water at present; and it was, generally speaking, of very inferior character. The other owners immediately adjacent had made no objection of any kind.

The Chairman: From whom are the 14½ acres to be purchased?

Mr. Boyle: The Bexhill and South of England Estate Company; the owners of a very much larger estate.

Mr. Soper said the petitioners were the owners of some lands called the Eversfield Estate, on the opposite side of the road from Hastings to Bexhill to the land proposed to be taken by the promoters. This was being developed as a building estate, with good-class property; and the portion adjacent to the site would come into the market in a year or two for building purposes. Therefore it was land which at present had great value; but it would be very seriously injured if gas-works were placed opposite it. While a remote portion might be low-lying, the greater part was on a slope, and commanded some very fine views both of the country and sea, which added to its value. There were already some houses being built on the property. On the question of *locus standi*, Counsel pointed out that the section incorporating certain Acts of Parliament specially excepted the provisions of the Lands Clauses Act with respect to the purchase and taking of lands otherwise than by agreement. This barred his clients from any claim for compensation they might have had against the Company for injury which the coming of the gas-works might do to their property. He thought it was the practice in the Upper House to admit opposition in cases where powers sought by a Bill would inflict undoubted hardship, as, he contended, would happen here.

Mr. Boyle said that, in the Company's Act of 1854, the exemption with regard to the Lands Clauses Act was identical with the exemption in the present case. The reason the exemption existed was that they were not taking any land under compulsory powers; and therefore to include the ections of the Act which dealt with compulsion would be exceptional and unnecessary. As to there being some houses there already, he was instructed that the nearest was two miles from the site.

Mr. Soper replied that he was not putting his case on the fact of there being some houses on the estate. The estate was, however, being developed; and if the Bill had been a year or two later, houses would have been already erected which would have given them an absolute right to be heard.

Mr. Boyle contended that the petitioners could have no *locus standi*; but he added that they need have no fear in regard to inconvenience that might be caused by the works, because they were protected by section 29

of the Gas-Works Clauses Act, 1847, which said that nothing in the Act should prevent the undertakers from being liable to an indictment for nuisance, or to any other legal proceedings to which they might be exposed, in consequence of making or supplying gas. Then Lord Morley had made an addition to clause 5 of the present Bill, to the effect that the Company "shall not create or permit a nuisance on any such lands." He contended that no case had been made out for exceptional treatment.

The Chairman: Is that the only opposition to the Bill?

Mr. Boyle: Yes.

The Chairman: The Committee are of opinion that the preamble may be granted.

The clauses were then formally considered, and adjusted.

HOUSE OF COMMONS COMMITTEE.

Monday, May 1.

Before Sir J. PEASE, *Chairman, Captain* BAGOT, *Mr.* ARNOLD FORSTER, *and Mr.* NUSSEY.)

EAST LONDON WATER BILLS.

The consideration of these Bills, the opening proceedings on which were reported last week (p. 1124), was resumed to-day.

Mr. Pember said he took it that when the adjournment was decided upon the Committee were of opinion that the promoters should, in view of the instruction of 1896, and the pending of the report of the Royal Commission, consider if it was advisable to proceed with the Bills.

The Chairman said the Committee hardly went so far as that; but Mr. Pember might adopt this view for the purposes of argument.

Proceeding, Mr. Pember said he thought if the instruction had been applicable to the present Bills, some reference would have been made to it by the President of the Local Government Board during the proceedings on the second reading, or by some members of the very active and positive section of the House of Commons who usually adopted a hostile attitude towards the proposals of the Water Companies. He ventured to suggest that the letter of the Local Government Board was the work of a subordinate official; for he could not conceive that, if it represented Mr. Chaplin's opinion, he would not have moved some instruction in accordance with it. On the subject of the report of the Royal Commission, he read a communication from Sir John Dorington, which was read to the House by the President of the Local Government Board, expressing the opinion that, in the judgment of the Royal Commission, the provisions of the Bills did not prejudice the questions before them. He pointed out that, while Lord Balfour's Commission had mainly to consider the question whether the Thames and the Lea were sufficient sources to provide a fit and proper supply of water for the needs of London for some time to come, the attention of Lord Llandaff's Commission was mainly directed to the consideration of the financial feasibility of purchase. The first report seemed to him the more germane to the Bills under discussion. Its most important finding was that London could depend on the Thames and the Lea for the next forty years. The Commission had distinctly before them the fact that the East London Water Company proposed certain works, of which the two reservoirs now contemplated were the most important instalment. The terrible drought of 1895 had hastened the necessity of complying with the scheme fathered by the Royal Commission of 1893, and had absolutely altered the conditions upon which the instruction of 1896 was given. Works that might not have been supposed to be of urgent necessity in 1896, even with the drought of 1895 behind it, had become so in the light of the still more bitter experience of 1898. In 1896, without the experience of 1898, Parliament had sanctioned the Staines reservoirs scheme, in face of the distinct and direct instruction of that year. This gave a supply of 45 million gallons daily to three Companies whose needs were nothing comparable to those of the East London Company. How much greater was the case for urgency in regard to the East London Company—the main sufferer in 1895, and the one sufferer in 1898. According to Mr. Bryan, the first of the reservoirs would be required in seven years' time. If this was the case, the Company should not delay. Moreover, the East London Company ought not to depend on the assistance of other Companies (whose needs were also increasing) one day longer than they were obliged. Intercommunication could never be intended, either by the Royal Commission or by Parliament, as a substitute for self-reliance. The Company's own resources ought to be sufficient for their statutory needs. Counsel went on to emphasize Mr. Baggallay's argument at the previous sitting, that Mr. Chaplin's Bill would not enable any Company to supply water to another Company in contravention of the distinct enactments of Private and Public Acts. Lastly, he said, the works would have to be carried out whoever was the owner of the undertakings; for it was perfectly clear that the London County Council's scheme of a Welsh supply could not be completed for fifteen years, even if commenced at once.

The Chairman said that, if Counsel's argument had any weight at all, it was clear Mr. Chaplin's Bill would be of no use if it did not over-ride the Water Companies' several Acts. Mr. Baggallay had pointed out that the Bill did not authorize the taking of any water except that which could be supplied by other Companies under any circumstances. He (the Chairman) had been surprised by the further argument that the Staines reservoirs water could not be taken for the purposes of supply to the East London Company. It, however, appeared clear, from the wording of the Act, that the Staines reservoirs would not come under the category of one of the Metropolitan Water Companies.

Mr. W. B. Bryan was re-called to explain some portion of his previous evidence. In reply to the Chairman, he said the Company could not rely on 32,000,000 gallons being obtained from the Lea, *plus* the 5,400,000 gallons for the navigation, unless the construction of the reservoirs now proposed was authorized. The Company must have storage for more than 7000 million gallons, in order to enable them to tide over such a period of drought as that of last year. At the present moment the Company had from wells an available supply of 10 million gallons a day; and by the end of the year they would have 12 million gallons a day. It was hoped to get another 8 million gallons from existing wells and wells in construction; bringing the supply up to the 20 millions which was reported by Lord Balfour's Commission as being the quantity which might eventually be obtained by wells from the chalk in the Lea Valley. The East London Company could not take any excess water from the Thames, and deliver it to the consumers. The 10 million gallons a day which the Company had at present, and which they had had for the past thirty years, was filtered at the Company's Thames works, and delivered in the ordinary way; but the additional water proposed to be obtained from the Thames would be filtered by other Companies, and delivered into the East London mains by other Companies. If the Company obtained power to take additional water, they would still have to go to other Companies to filter it; and the water would be delivered into the East London district by other Companies. The East London Company's own main from the Thames was not at present capable of delivering more than 10 million gallons a day. Works were in progress by which it was hoped the Company would get 2 millions a day more through the main, which 2 million gallons would be drawn from the gravel springs at Hamworth. At Hamworth, the storage capacity was only equal to 5 million gallons. The works had been in operation since 1870. In times of considerable excess of water in both valleys, if the water of the Thames was very turbid, the Company took very little of it; drawing more from the Lea. At such periods, there was probably greater excess in the Lea; and so the difficulty of having a large storage on the Thames was obviated. At the same time, the Company pumped all the water they possibly could from the gravel springs; this water being absolutely bright and clear before filtration. Even when the Thames was turbid, therefore, a most excellent water was obtained from the Thames works. The more northerly of the proposed reservoirs would contain approximately 2500 million gallons and would cost, without appurtenances, £330,000; the other would contain 3000 million gallons, and would cost £420,000.

In reply to Mr. Arnold Forster, witness said the water in sight when the proposed reservoirs were completed, and the supply from wells was brought up to the 20 million gallons a day, would be 64 million gallons a day. This would be sufficient to meet the demands for the next twenty years. Assuming a drought like that of 1898, and the reservoirs authorized in 1897 completed, the Company would have an available supply of 31 million gallons a day, made up of 10 million gallons from the Thames, 2 millions from the Hamworth springs, 12 millions from wells in the Lea Valley, and 7 millions from the Lea. With the help of 5 million gallons from the Southwark and Vauxhall Company, and 6 millions from the New River Company, the supply could be brought up to 42 million gallons a day. But the 1897 reservoirs would not be completed for 2½ years; and if Providence sent in July this year another such drought as the one of last summer, the means of intercommunication with other Companies would have to be utilized to the fullest extent.

By Captain Bagot: Before the end of twenty years, assuming the population to have increased at a decennial rate of 18·2 per cent., the Company would have to go to Parliament for other schemes for more water, in addition to the proposed reservoirs.

By Mr. Nussey: As far as witness could tell, Mr. Chaplin's Bill would only legalize the interchange of water between the Companies, and gave no power to take additional water from the Thames. It did not legalize the obtaining of water from the Staines reservoirs, and the Southwark and Vauxhall Bill of last year expressly prohibited the Company giving a supply to the East London Company; so that unless this disability were removed, possibly the Southwark and Vauxhall Company might be prevented from giving the East London Company even the 5 million gallons a day. There was opposition to the Company's wells, on the ground that they denuded another part of the district of water.

Witness was cross-examined by Mr. Kemp, for the London County Council, to show that, with their present connections, the Company could meet any exceptional circumstances for the next two years. In his evidence before the Royal Commission, he had stated that the Company might count on assistance from the other Companies to the extent of 15 million gallons, excluding the Kent Company, who could give but a very small amount. He excluded the Chelsea Company also, because he did not know whether they had filtering or pumping power sufficient to give their surplus 2 millions. If they did give it, it would mean very considerable additional works, though he believed these works were proposed in Mr. Chaplin's Bill. He could not say that if the West Middlesex Company were allowed at once to take from the Thames the 5 million gallons they were asking for under their Bill, this 5 millions could be supplied to the New River Company. The new main of the Southwark and Vauxhall Company would enable the Company to give 10 million gallons a day in future. Of course, if the East London Company were going to get 20, 30, or 40 million gallons by the execution of the intercommunication scheme, this would be sufficient for present requirements; but if they rested content, it would be going in face of the interim report of the Royal Commission, that the construction of these works should not relieve the Company of the responsibility of coming to Parliament for new works.

The Chairman: If the powers sought in this Bill were granted, you would be abie to supply in twenty years' time your then population, supposing it increased from now at the rate of 30,000 a year—that was, roughly, 1 million gallons per diem increase in the consumption to provide year by year?

Witness: That is so. At the end of twenty years, we should have to seek parliamentary powers to supply the future population.

By Mr. Nussey: Supposing there was a drought in the twentieth year, the Company would be able to supply; but it would be prudent, if the population increased as just now, to come to Parliament two or three years prior to the resources of the present scheme being exhausted.

Mr. E. M. Eaton said that, in consequence of the failure of supply last year, Mr. Mansergh, Mr. Hill, and himself were directed by the Company to advise as to the best means of obtaining an additional supply. Their joint report recommended the construction of the works now proposed. It was essentially necessary that the total storage capacity of the Company should be brought up to 7000 million gallons. Lord Balfour's Commission assumed 35 gallons per head per day consumption, and a rate of increase in the population of 18·2 per cent. every ten years. These figures were assumed also by Lord Llandaff's Commission, and adopted by the two gentlemen he had mentioned and himself in their calculations. He confirmed the figures given by the previous witness as to the water required during the next twenty years, and the sources

from which it was proposed to obtain it; and he said the River Lea, taken as a watershed, was capable of giving a great deal more water than was contemplated under the Bill. Assuming a rainfall of 26 inches over the Lea Valley, the total drainage area down to Fielde's Weir was capable of yielding 87,600,000 gallons a day, which quantity might be used, if the storage capacity was sufficient, without in any way affecting the condition of the Lea except in dry years. It was the essence of a storage scheme that provision should be made for the worst season which could be contemplated; and the figures given were based on the needs of three consecutive dry years. In dealing with the impervious formations of the North of England or Welsh watersheds, provision would have to be made for the storage of the whole yield; but, in the case of the Lea Valley, Nature herself provided storage for 24½ millions out of a total of 87½ million gallons. He looked upon the provision for taking 10 million gallons a day from the Thames in the light of an insurance fund. It was to be taken by other Companies and passed on to the East London Company; and as it was only to be taken subject to the sanction of the Local Government Board, the public were amply protected from any abuse of the privilege.

Mr. G. H. Hill said he was a member of the Royal Commission of 1893. He agreed with what Mr. Eaton had said about the joint report of Mr. Mansergh, Mr. Eaton, and himself. He thought the scheme as laid before the Committee carried out the recommendations of Lord Balfour's Commission of 1893.

In cross-examination by Mr. Balfour Browne, witness admitted that the Commission of 1893 had not the opportunity of considering the question of bringing water from Wales.

Mr. Eaton was re-called for cross-examination, and in reply to Lord R. Cecil said that to the extent that water was taken out of the chalk which otherwise would have flowed into the river, the stream was denuded.

Sir Frederick Bramwell stated that he had modified the opinion expressed by himself in 1897, that the reservoirs then in existence, taken with those authorized, would be sufficient to carry the Company on for some years. In order to use the Lea to the best advantage—that being a very large item in the available sources of the Company—the proposed works were absolutely necessary. Witness handed in details as to the average monthly flow of the stream over Fielde's Weir. It was most important that the Bill should be passed this year.

Mr. J. W. Restler, Engineer to the Southwark and Vauxhall Water Company, said that under the conditions of last year, and subject to the consent of the Thames Conservators, there was no doubt that his Company could supply at least 6 million gallons a day to the East London Company. This, however, was not a quantity which the Southwark and Vauxhall Company could pledge themselves to supply indefinitely. The new main now being constructed with the intention of connecting this Company with the East London system would be capable o conveying 10 million gallons a day.

Mr. Balfour Browne, in addressing the Committee, asked them to adhere strictly to the instruction given in 1896. Dealing with the Bills promoted by the London County Council in 1895 for the purchase of the water undertakings, he said that the dissolution of that year prevented their passage through Parliament. He said the instruction of 1896 was given with the view of not prejudicing the action of Parliament on the question of purchase, and in view of the Metropolitan Water Board Bill introduced by the Government giving Local Authorities the opportunity of dealing with the whole matter. In 1897, when the County Council Bills were re-introduced, they were rejected on the ground that the Government were going to appoint a Royal Commission to report on the financial feasibility and propriety of purchase. It would be unfair, now that the Commission were about to report, to allow the East London Company to spend £1,500,000 on new works, while the County Council Bills were suspended. The Committee should hesitate to pass new Water Bills unless there was some absolute public urgency. There was no such urgency here; and the expenditure of £1,500,000 on the proposed works would clearly prejudice the Purchase Bill of the County Council. No doubt if the Company were bought on their present basis, they would be bought for very much less than if the works were authorized. The three Bills promoted by the County Council were now hung up pending the report of the Royal Commission. What was sauce for one was sauce for the other; and under these circumstances, it would be unfair to allow the East London Company to spend a large sum while the County Council Bills were suspended. He contested the argument that Mr. Chaplin's Bill did not give power to the Companies to take water for supply to the East London Company. Whatever defects there were in the Bill, however, were capable of amendment when it came before a Committee of the House of Lords in a day or two.

Sir Alexander Binnie, in answer to the Committee, said that he had stated before the Royal Commission that the provision of a water supply to London from Wales would take from ten to fifteen years after the passage of the Bill. It was possible, however, that the Royal Commission might report that it was not necessary to go to Wales; and under these circumstances he thought a very ample supply could, with the assistance of the East London Company, be obtained from the Thames, and not the Lea. He contended that the Lea as a source was nearly exhausted, as was proved by the failures of supply in 1895, 1896, and last year. The experience of last year was so exceptional that it beat the record of any of the London Water Companies, going back even to the beginning of the century. If the Royal Commission should recommend the Thames, a supply might be obtained from the river very much cheaper and sooner than was proposed under the present plan. Meanwhile, the scheme embodied in the interim report of the Royal Commission was amply adequate to meet temporary requirements.

Mr. Pember thought he was entitled to express the opinion that the letter of the Local Government Board was a very strong proceeding.

The Chairman said no doubt the Local Government Board had some strong ground for thinking it their duty to remind him that three years ago, under a different set of circumstances, such an instruction was given; and suggesting that the Committee should take it into consideration. Still, it was a very strong proceeding; and some Chairmen might have resented it very much. The Local Government Board were, however, a great authority; and the Committee had not stood upon their dignity.

The Committee having deliberated, the Chairman announced that they had decided that the preambles of both the main Bill and the temporary supply Bill had been proved. They intended to put in the sinking-fund clauses.

Tuesday, May 2.

To-day the Committee proceeded to go through the clauses of the Bills.

Lord R. Cecil, on behalf of the Herefordshire County Council, produced a clause, which he asked the Committee to insert for the purpose of imposing on the Company an obligation to furnish the Council with returns showing the amount of water pumped by them from their wells in the county, so as to enable the effect of the pumpings on the local wells in the same area to be gauged.

The Chairman, in announcing the decision of the Committee not to accept the proposal, said that the personal opinion of the Committee was that such records ought to be kept by the Company.

On the question of certain Lammas lands over which the parishioners of Chingford have common rights, Mr. Birkett, representing the Commons Preservation Society, said they had no objection to raise to the arrangement which had been made. The Chairman remarked that the commoners would get their rights; and the public would get what they did not at present possess. There would be an open space of water instead of land, which would be better than undrained marshes. Mr. Burn, of the Chingford District Council, said they agreed to the commoners taking payment for loss of grazing rights; and they also agreed to the reservoir, on the score of public health. But they did not desire to be put to the expense of keeping up 5 acres of recreation ground which were unnecessary. On behalf of the City Corporation, Mr. Rigg said the land might be taken as an addition to Epping Forest by the Corporation; but ultimately Mr. Burn consented, on behalf of his Council, to take the land and keep it as an open space.

With regard to the sinking-fund clause which the Committee desired should be introduced into the Bill, Mr. Littler pointed out that the clause which the Company had brought up would exclude a very large portion of the new capital from the operation of the sinking fund; and he asked the Committee to include the whole of the capital. In this he was supported by Mr. Balfour Browne and Mr. Rigg, who raised similar objections.

The Committee decided that the whole of the capital raised under the Bill should be subject to the action of the sinking fund as soon as the new reservoirs began to supply water.

Mr. Urban Smith was then called to show the injurious effects which the Company's pumping, and that of the New River Company, had had upon local wells in Hertfordshire; Lord R. Cecil urging the Committee to prevent further injury to the wells by inserting the following clause: "None of the capital authorized to be raised under the provisions of this Act shall be applied to the sinking of any new well or to the acquisition, completion, or enlargement of any existing well."

The Committee expressed a wish that the clause should not be pressed; the Chairman remarking that, however necessary or proper it might be, the matter was beyond the scope or jurisdiction of the Committee.

The Committee were then asked, on behalf of the London County Council, to insert the following clause: "If the undertaking of the Company is purchased within seven years from the passing of this Act, otherwise than by agreement, by any public body or trustees, nothing in this Act shall authorize the Company to bring into account, or to make any claim in respect of, any advantages conferred on them by, or resulting from, the passing of this Act."

The Committee decided to reject the clause; and the remaining clauses having been disposed of, the report was deferred.

The Committee subsequently reported that, pursuant to the Instruction of the House of the 20th of April, they had consolidated the Company's two Bills into one, "to authorize the East London Water-Works Company to construct additional storage reservoirs and other works, to take further water from the River Thames in cases of exceptional drought and other emergency, to raise further money, and for other purposes." Reports from the Local Government Board and from the Board of Agriculture relative to the Bill had been referred to, and considered by, the Committee, who had given effect to the recommendations contained in the report of the former Board, so far as they deemed the same applicable to the consolidated Bill as passed. With reference to the Instruction of the House of the 21st of March last, the Committee took evidence which satisfied them that no public right existed over the lands in question; but, having regard to the terms of the instruction and to the resolution of the House of 12th of March, 1896, the Committee had, with the consent of the promoters, inserted such provisions in the Bill as would ensure the conveyance to the Local Authorities of an area of 10 acres, within the limits of deviation shown on the deposited plans, for the purposes of an open space. The Committee took evidence which satisfied them that this arrangement met the views of the Local Authorities. The Committee considered that the provision inserted by them in the Bill sufficiently met the suggestions with reference to the same matter contained in the report of the Board of Agriculture on the East London Water Bill.

Luddendenfoot Water Supply.—Sanction has lately been received from the Local Government Board to an application by the Luddendenfoot District Council for permission to supply their district with water. The Council will purchase the water from the Halifax Corporation. Hitherto the district has been supplied by the Sowerby Bridge District Council.

Suicide by Gas.—An inquest was held yesterday week at Halifax relative to the death of the Rev. James William Braithwaite (aged 57), who resided with his sister. It was stated that he was formerly a Unitarian minister at Christ Church, Nottingham, having resigned about two years ago, on account of failing health. He was suffering from cancer in the head. In her evidence, Miss Braithwaite stated that she entered her brother's room about nine o'clock on Sunday morning, and was struck with the strong smell of gas. Mr. Braithwaite was sitting on a chair by the dressing-table under the gas, with an india-rubber tube in his mouth, tied round his neck with a piece of string, and she noticed that a sponge had been cut up, and that he had forced pieces of it into his nostrils. He appeared to be dead. Dr. Macaulay was called in, and was of opinion that death was due to suffocation by coal gas. A verdict of "Suicide while of unsound mind" was returned.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Wednesday, May 3.

(*Before Mr. Justice* STIRLING.)

Carr and Co. v. Bath Gaslight and Coke Company.

This was an action to restrain the defendants from discharging, or permitting to be discharged, at their works at Weston and Twerton petroleum oil, hydrocarbon, or any refuse or noxious matter into the River Avon, so as to pollute the water of the stream when it passed the mills of the plaintiffs.

Mr. C. M. WARMINGTON, Q.C., Mr. PHIPSON BEALE, Q.C., and Mr. INGLE JOYCE appeared for the plaintiffs; Mr. BUTCHER, Q.C., Mr. FOOTE, Q.C., and Mr. PARKERS represented the defendants.

Mr. WARMINGTON said this was an action brought to restrain the defendants from polluting the water of the River Avon. The plaintiffs were manufacturers of woollen cloth upon the banks of the river; and they used the river water for many operations in their mills. The works of the Gas Company were situate about half-a-mile from those of the plaintiffs. The defendants' works were on both sides of the river; and they for some time manufactured gas in the usual way from coal. Between the plaintiffs' mill and the defendants' works, the river had but a sluggish flow. It was important that the water which was taken from the river by the plaintiffs, as riparian owners, should be as pure as possible. In May, 1898, the plaintiffs discovered that there was mixed with the water which they took into their mill from the river, what might be described as oily tar. Of course, tar was a residual from the manufacture of coal gas; and he thought he was right in saying that the way this tar was dealt with (it being a valuable article of commerce) was that it was loaded into barges at the defendants' works, and carried down the river. There might have been leakage from the barges; but it was never serious enough to interfere with the plaintiffs' manufacture. He thought that what the plaintiffs had suffered was due to the defendants having embarked in the manufacture of water gas from petroleum oil, the refuse from which had found its way into the river, where, if it was left alone, it would in course of time sink to the bottom. But having sunk to the bottom, decomposition set in, and the oil came upwards. It did not float on the top, but was mixed with the water.

Justice STIRLING said the sole issue between the parties was pollution or no pollution.

Mr. WARMINGTON said that was so. The result of the presence of oil in the various operations which were performed in the plaintiffs' mill, was that the cloth was covered with spots, and ceased to be an article which they could use. It was not a matter in respect of which there was any difficulty on the part of the defendants in preventing such an injury arising. The trouble which the plaintiffs had experienced from May, 1898, up to this time had not been continuous. There were occasions when they did not suffer at all; and he suspected the reason of this was that sometimes defendants were not manufacturing water gas, or, if they were, they were so conducting the operations that they prevented the slightest outflow from the works into the river. As he was instructed, there was no difficulty in disposing of this residual.

Mr. BUTCHER said he did not know whether his learned friend would say now whether it was alleged the injury still continued, or whether it was confined to the date of the action. If it was confined to the issue of the writ, the question would be solely one of costs.

Mr. *Jonathan Carr* was then called, and deposed to the injury which his Company had suffered from the pollution; but he admitted that for the last two months there had been nothing to complain of.

Mr. BUTCHER said the case seemed to be narrowed down to the question of who was to pay the costs.

Mr. BEALE said that there must be some assurance that, as the defendants could prevent the nuisance, they would continue to do so.

Mr. BUTCHER replied that the defendants had always taken the same precautions that they did now; and at no time had any of the residual products got into the river. From start to finish that had been their contention; and he ventured to think he would prove it.

Mr. BEALE: Do you say you have altered your apparatus?

Mr. BUTCHER said it was absolutely the same now as it always was.

Mr. *Thomas Newbigging* was next called in support of the plaintiff's case. He said he visited Bath on June 24, with the view of ascertaining the cause of the impurities found in the river. He visited the mill, and applied for admission to the gas-works; but this was refused. He inspected the surroundings of the defendant's works, and found oil or tarry matter. He noticed barges passing up and down the river; and owing to the disturbance, the tar rose to the surface, and floated down. He then procured a boat, and pulled up the river; and every little while he saw the tar rising from the bottom and spreading. He took samples of the water, which he now produced. These samples were strongly impregnated with the residual products from water-gas manufacture. They were distinct from the products of ordinary gas. The only conclusion he could come to was that the residuals had been turned into, or had escaped into, the river. There were several ways of disposing of the residuals from the manufacture of water-gas. Originally the tar was employed as fuel under the steam-boilers; but within the last two years another use had been found for it—viz., in the manufacture of printers' ink—and it was also mixed with coals. The effluent consisted of particles of tar, some oil, and some water; and this was allowed to run into the river. In some places it was worked round and round again and evaporated, and did not increase in bulk. This was how they dealt with it in Manchester. At other works, they ran it on to any waste land, and allowed it to filter into the ground. At Tottenham, they were doing this; and a spark from a passing railway engine set fire to it, making a fine blaze. On July 4 he visited the defendant's works, in company with Mr. Gatehouse. The apparatus then in use consisted essentially of three parts—the generator, the carburetter, and the superheater. In addition to these, there were certain adjuncts—namely, a washer or scrubber and a separator. The generator was a cylindrical vessel lined with fire-brick, as were also the carburetter and superheater. Coke was placed in the generator, and lighted; and then a blast of air was sent through it. After it attained a cherry red heat, steam was injected into the generator. This steam was decomposed into its constituent gases, hydrogen and oxygen. The hydrogen was free; but the oxygen combined with the coke, forming carbonic oxide. In passing into the next vessel, they met with a spray of oil, which became vaporized in the carburetter, and mixed with the other gases. At this stage, the oil had not been converted into a permanent gas; it did not become a permanent gas until it was in the superheater. The residual tar and water was condensed, and ran off into the separator. The tar, or a large bulk of it, sunk to the bottom of the separator; and what was called an effluent—which also contained tar and some oil and water—was allowed to run away. This was the arrangement when he visited the works on July 4. The Manager told him that the effluent was allowed to flow into the river after the bulk of the tar had sunk. The tar was then run into a small tank adjoining, and from this tank was pumped into barrels on wheels, and was taken away to the other end of the works. It was then pumped from the barrels into an elevated cistern, and from there was allowed to flow into the coal-hoppers in regulated quantities. The whole system appeared to be a hand-to-mouth arrangement. The receptacle for the tar was not large enough—only holding about a day's stock. The result was that there would be a lot of spilling of tar in the yard. He examined the river below the works, and found what he had stated; but up above there were no such impurities. On Dec. 2, he again inspected the works. The water-gas plant was not then in operation. On this occasion, he noticed one material alteration—viz., the construction of an effluent-tank. The effluent, instead of flowing into the river, was allowed to run into the tank; and from the tank it flowed into a big gasholder tank. From there it was pumped into an elevated tank, and then fed into the washers. The result would be that the water would run into the ammoniacal liquor well, and be pumped from there across the river to the sulphate works. He was not sure that this was an improvement upon what he saw before; for at the sulphate works it again became effluent, and ran into the river as it did before.

Thursday, May 4.

Mr. *Newbigging*, cross-examined by Mr. FOOTE, said it was principally the smell that told him the water was impregnated with oil tar. There was no difference in appearance in river water when polluted with oil-gas tar and water-gas tar. He had not had the result of the analysis of the water submitted to him. No doubt the analysis would show the difference between one tar and the other. The samples were drawn from the bottom of the river. Of course, they avoided taking the mud as far as they could. They did not select a good site above the gas-works to get the sample of clear water which he produced; the water was very clear within a foot of the surface. It was a fair sample of the river at that particular place. Sewage, as a rule, floated pretty near the surface. The sample produced was pumped through the sewage, so as to get no scum or floating-impurities. Water-gas tar had not the same commercial value as coal-gas tar. A large settling-tank, in addition to the separator, was to extract all the tar. He understood that the Gas Company did not now turn the effluent into the river, but circulated it over and over again until it evaporated. This was what they should have done at first. There was no leakage from the separator or from the tank. The pollution in the river was not crude oil, but the residual. He noticed no other imperfections in the gas-works from which coal-gas tar could get into the river.

Dr. *E. H. Armstrong* said he had examined several samples of water taken from the River Avon. The one taken above the works of the defendants had a foul smell; but it had no oily matter in it. The sample taken near the gas-works contained a large amount of oil. One sample taken on Nov. 16 was simply all oil-gas tar. Having had considerable experience with tars, he should say that oil-gas tar was totally distinct from coal tar, it differed in appearance, odour, and texture; and it contained many substances quite different from those in ordinary tar. An enormous amount of water was taken by the plaintiffs from the river for scouring raw wool; and it would be practically impossible to get rid of the oily substance by any process of filtering, because oily matters would go through all filters. He inspected the gas-works on Saturday last, when the water-gas plant was in operation. The conditions were as described by Mr. Newbigging; but some time since the beginning of the year arrangements had been made by which the water was not allowed to flow off, but was pumped back to the scrubber and circulated over and over again, so that there was no escape. Short of absolute carelessness on the part of the workmen, the present arrangement was sufficient. It might easily happen that tar would be put into the river, if there was over-production or insufficient storage accommodation, or even if the workmen—especially the night shift—were a little lazy. In his opinion, the storage accommodation was insufficient. He considered that there must have been something more than effluent or leakage to cause the condition of the last semple which was taken.

Cross-examined: The carelessness which would get crude tar into the river, was carelessness with intent—that is to say, the stuff would be actually tipped into the river. At one time oil tar was unsaleable; but its value was now gradually being recognized. Only certain distillers could use it; so that it might have a value in one place, but not in another. It could be employed in the manufacture of gas; and consequently gas companies would not willingly throw it away. All the samples of water, except those taken above the gas-works, smelt of oil-gas tar. When a stagnant pool near the plaintiffs' mill was stirred up last Saturday, a large quantity of oil-gas tar was brought up. The plaintiffs had the right to lower the stream 3 feet by drawing the hatches; and as this was done last autumn, the fact that oil-gas tar was found there on Saturday showed that there had been recent pollution. In his opinion, the defendants should erect a tank sufficient for ten days' supply, unless they could depend upon the make each day being used up.

Mr. *E. H. Shepherd*, examined by Mr. JOYCE, said he was Inspector and Surveyor to the Bath Rural District Council. His attention had been called during the last two years to the condition of the water in the river. The water near the defendants' works contained a large amount of tarry matter. On taking measures to ascertain where the tar came from, he found one drain at the west-end of the gas-works, and one at the east-end, discharging what he took to be tar. On pointing this out to the Manager (Mr. C. S. Ellery), he said perhaps it would be better when the

river was drawn on Bank Holiday (May 30). When the river was drawn, witness found a deposit of brown tar in the bed; and he had a sample scraped up, which he examined and smelt. He then walked up the river; and his attention was directed to one or two little deposits of scum above the gas-works. This he examined; but he could detect no smell of tar. A little further up the city sewermen were engaged in removing the *débris* from the mouth of the sewer; and no tar was found there. Mr. Ellery afterwards undertook to have the drains examined from which the tar escaped, with the result that they were walled up in May, 1898. He also caused a trench to be sunk in the towing-path, so as to intercept one of the drains; and a small sump was put in to prevent the tar from reaching the river. Mr. Ellery asked him to go to the gas-works, because they had made some tar paving, and he thought the rain had washed the tar out of the pavement; but this was not witness's opinion. On June 4, he again inspected the river in front of the gas-works, and found a large upheaval of globules rising very rapidly and spreading half-way across the river. He also noticed an iridescent appearance. There was nothing of this kind higher up the river. On June 24, when he made a further inspection, the emission seemed to be much stronger and more frequent than on other occasions. There were the same brown globules rising to the surface, and spreading on the top of the water. He also examined the river higher up on the same day, but did not find anything of the kind there. He could not account for the presence of the tarry matter in the river, except that it came from the defendants' works. On Dec. 8, when the river was in flood, he again noticed what he had already described. Lately the condition of the river had much improved.

Mr. *H. J. Graham Montague*, Inspector of Nuisances, deposed that he was present in company with others when the river was disturbed in front of the gas-works; and he noticed the iridescent appearance deposed to by the previous witness.

In cross-examination, witness said he was not an expert in iridescent matters, and could not say whether the iridescence was due to anything that came from defendants' works.

Mr. *J. W. Gatehouse*, Public Analyst of Bath, examined by Mr. Warmington, said that he had known the river for the last 33 years; and in consequence of instructions received from plaintiffs' advisers, he visited the mill on May 24, 1898. In the water just above the weir, there were iridescent matters and brown particles floating down, having the appearance of oily matters spreading out on the surface. On May 25, he took samples of the water at nine different points. Those near the gas-works smelt strongly, and contained some hydrocarbon products; but there was no trace of petroleum in the samples from above the gas-works. He also on other occasions took samples from the bed of the river, and found that in those taken below the gas-works there was much heavy petroleum oil, but not in those from above. He agreed with what Mr. Newbigging had said about the samples.

Friday, May 5.

Mr. *Gatehouse*, in cross-examination by Mr. Butcher, said his opinion was that the pollution was due to petroleum oil which escaped from the oil-tank at the gas-works. He did not suggest that there was any leakage at the present time. He had seen many impurities in the river above the gas-works, but not water-gas tar. He had found tarry matters, which on analysis turned out to be coal tar. Water-gas tar was heavier than water, and yet a portion of it floated, being supported by the iridescent film which mixed with it, and by surface tension. Various spots were suggested by Mr. Ellery and some of the Directors where pollution might be noticed; and he found different matters above the old bridge, including traces of petroleum oil. But it was a very light oil, quite different from the heavy oil he found near the gas-works. He had inspected the gas-works on July 4 and Dec. 2; his object being to see if there were any source of leakage into the river. All facilities were given; but when he began asking Mr. Ellery certain questions, Mr. Ellery was advised not to answer them. He could not say now what the questions were; he took no note of them. Some eighteen months before, Mr. Ellery showed him the nature of the process. On July 4, he saw the oil-tank; and there was no leakage then. He also saw the separator, but did not understand how it worked. He could not say that it would separate the whole of the tar from the water in which it was suspended; he was sure it would not do so, unless it were left several weeks. He had condensed an appreciable quantity of water-gas tar from a quart of perfectly clear river water, which only smelt slightly of tar. He was not aware when the manufacture of water gas was commenced; but he knew it was going on two years ago. In December the process was not at work, but an offer was made to set the plant going, and that he should see it early the next morning. But on consultation with Mr. Newbigging, they decided that it would not be a fair test, as the process would not have been going on long enough for him to form any conclusion. There was tar at the bottom, and water above, on that occasion; but no measurements were taken. They were not informed how much tar was produced per day. He saw no mode of escape of tar from the separator into the river, except through gross negligence. Apparently the only means by which tar could get into the river would be in the effluent. He took no sample of the water from the separator, but he did from a smaller tank into which the water flowed. On July 30 the river was very low. He did not then see any tar percolating through the embankment wall of the gas-works; but the mud had a lot of water-gas tar in it. There were several pipes then visible which were not ordinarily seen. The ends of these were full of muddy tar; but he could not say it came through them. There had been no cause of complaint since the end of 1898, though he had seen slight traces of tar and tar oil in the river. The general result of his observations was that, in his opinion, when he made his report the tar in the river drained from the gas-works. Probably this was why he was invited to make another inspection in December. They then asked for a plan of the drains, but did not obtain it. He could not say why no cause of complaint arose before April, 1898, if the works had been carried on since 1895; he knew nothing about it.

Re-examined: The separator worked by gravity simply. It was extremely difficult to separate the whole of the tar from water.

This concluded the plaintiffs' evidence; and Mr. Butcher intimated that he would call his witnesses at once.

Mr *C. Stafford Ellery*, examined by Mr. Parkers, said he was Engineer and Manager of the gas-works, and was there constantly. The Company manufactured coal gas and carburetted water gas, and also converted ammoniacal liquor into sulphate of ammonia. The manufacture of carburetted water gas had been carried on since October, 1895; and that of sulphate, from 1881. He produced a plan of the works. He would accept Mr. Newbigging's description of the manufacture of the water gas. The residuals from the process were led into the separator. The water and tar flowed in together at one end; and the tar being heavier subsided. Some of the lighter tars had a tendency to pass forward; but there were diaphragms to keep them down. The water deposited the whole of its tar in the lower part of the vessel; and as an additional precaution, he put a skimmer at the outlet, which would catch any light oils which might float on the surface. There might be infinitesimal traces of light oils in the effluent; but the tar was completely removed. The water gas was mixed with the coal gas in a hot condition, before any purification took place. After the mixing, the tars from both gases fell together. The first complaint by the plaintiffs was early in May, 1898. The storage capacity included the tar-tank, and the lower part of the separator. The tar-tank had a capacity of 800 gallons; and the average daily production was something under 200 gallons. The storage was therefore quite sufficient. They had had an offer for this tar recently at the same price as coal tar; but it was worth more to them for their own purposes. The manufacture was carried on the same way now as it always had been. There was no carelessness among the men, as had been suggested. The greatest care was taken of the tar, as it was a valuable product. The first complaint was from Mr. Carr, in May, 1898; and then Mr. Gatehouse called. Mr. Gatehouse at first thought the oil-tank was the source of the complaint, and a special test was made to see if there was any leakage; the manufacture being stopped several days at the time. This was done twice; but no leak was discovered. The process was stopped from June 10 to Aug. 25. The tank was above ground; and any leak would have shown itself. The next suggestion was that the effluent might be defective, but only in a general way. It was tested by being passed through hay; and it was found that only an infinitesimal quantity of matter was caught—mostly carbonaceous. The effluent flowed directly from the separator into the river by a pipe which was visible; there was no concealment about it. The drain spoken to by Mr. Sheppard was at another part of the works quite distinct from this manufacture. The works were built on the site of a lot of old cottages, all of which had had drains running into the river; and he had no plan showing how the old drains ran. There was still a good deal of property which drained into the river through the drains under the works. He saw some iridescent matter come in this way on the occasion of one of the inspections. On July 4, when the inspection took place, water-gas manufacture had been stopped for the summer. He was quite willing to answer any inquiries; but after a consultation between the Solicitors, the questions referred to were not put. He should have been very grateful to the plaintiffs or their witnesses if they could have pointed out a serious loss of oil or tar from the works. He had taken every possible means to discover if there was any leak. Mr. Newbigging charged the separator with being the offender immediately he saw it. Mr. Ellery then described the method of washing and scrubbing, which produced ammoniacal liquor, and the manufacture of sulphate from the liquor. This was done on the other side of the river; the liquor flowing across in pipes by a bridge. The effluent from the ammonia works went into the river, as it had done since 1881. He sent samples of the effluent from the separator and from the ammonia works to Mr. Stoddart, for analysis. The process he had described went on from Aug. 15 to March 14. Since then the water had been used over and over again for washing, and did not go into the river at all. He remembered visiting plaintiffs' works, and noticing iridescent matter on the surface of the water, which he pointed out to Mr. Carr. Last summer the river was very low, and in a bad state—like an open sewer. On the occasion referred to, he walked up with Mr. Carr towards the gas-works; and the nearer they got to them, the better was the condition of the water. On the occasion of Mr. Newbigging's visit, he took him above the gas-works, and showed him the condition of the river there. On throwing in stones, iridescent matter came up in considerable quantity. Six samples of water taken from the river were sent to Mr. Stoddart. Three, taken at the destructor works, were pumped from the bed of the river; and the other three were taken by Mr. Langford at the old bridge. On Sept. 15, he accompanied Mr. Stoddart when he made an examination of the river. They started at the old bridge, about a mile above the gas-works, and rowed down. Witness made no notes; but Mr. Stoddart did. On stirring up the bottom, iridescent matter rose. It was worse opposite the gas-works. There were various drains discharging into the river; but they could not trace this matter to any of them in particular. There were other works up the river—cabinet-making works, dye works, electric light works, several oil merchants, a currier's yard where large quantities of petroleum were taken, and the Corporation yard where asphalte for the road was manufactured. The river was very offensive; and there were thousands of fish lying dead on the banks. In February last, he again accompanied Mr. Stoddart on a similar expedition. The water was in a much better condition; but on disturbing the bottom, iridescent matter was again thrown up. Samples were taken on this occasion also. The river was much fuller now than last summer. They sold about 2000 tons of coal tar per annum. It was mostly sent down the river in barges; but some was used by the Corporation for paving purposes. He denied that the impurities complained of came from the gas-works. Short of gross carelessness, this was impossible.

Cross-examined by Mr. Warmington: Coal-gas tar and water-gas tar were quite distinct bodies. He admitted there had been water-gas tar in the river between April and December, 1898. Since April, 1898, his attention had been directed to the question of the existence of water-gas tar in the river. He had found it present above the gas-works on various occasions. It was found more particularly round the drain from the destructor. Samples were taken on two occasions—one was submitted to Mr. Stoddart, and the other to Mr. Coppack, a local chemist. Other samples taken had not been preserved. Oil-gas tar was lighter than coal-gas tar, and spread into a thinner film; he could distinguish between them on water by their appearance. He had seen what he took to be water-gas tar on the river since May, 1898, and had seen it rise from the bed of the river when it was disturbed. This was what he saw on May 23 from the window of the plaintiffs' mill. It covered the surface. An escape of tar from the gas-works would not float down to plaintiffs' mills

on the surface. Bubbles rose from the bed, bringing up the lighter particles of the tar; and this would be caused by fermentation or disturbance. There was no water-gas factory above the gas-works that he knew of. Water-gas tar might get into the river through the drains; but he had not been able to ascertain that there was any house or factory where such tar was made or kept. The samples produced by Mr. Gatehouse had not been tested on his behalf. The plan of the works was ten or fifteen years old, and had been corrected from time to time. The skimmer was added to the separator soon after October, 1895; it was found to be necessary, in order to prevent the escape of traces of the light oils. The highest daily production of water-gas tar would be 240 or 250 gallons; but it would rarely be above 200 gallons. On May 19, 180 gallons were made; and that continued until about the 26th. It was all utilized in producing gas. The tar flowed from the separator into a tank, from which it was pumped into barrels, which were wheeled to the other end of the retort-house; and from thence the tar was pumped to a tank in the roof. A careful man had charge of the operation exclusively. The hay filter was alongside the separator, and consisted of a series of trays, one above the other. The hay was in an open channel, along which the effluent flowed. It would have been impracticable to let the effluent rest on the hay, without stopping the work. It did not occur to him to take a given quantity and test it in this way. The experiment continued a few days, and was seen by Mr. Gatehouse. The samples produced by Mr. Gatehouse were shown witness; and he said they no doubt contained water-gas tar, but how much, and what else was present, he could not say. The samples he took from the river near the destructor did not smell of sewage, but of water-gas tar. The bed had been disturbed at several places; but he could not say how many. Iridescent matter, smelling of water-gas tar, rose in varying quantities. He had not obtained samples of water above the works which would compare with those taken below in the quantity of water-gas tar. He had no theory to account for this; he wished he had.

Re-examined by Mr. BUTCHER: He considered the hay filter would arrest anything present in the effluent water.

Mr. *W. Langford*, Assistant-Engineer to the Company, was next called to prove the taking of samples of the water from the surface of the river, on July 1, near the old bridge. These were bottled and labelled, after being taken with a skimmer.

Mr. *Joseph Cash*, Engineer and General Manager of the Brighton Gas-Works, said his Company made about 1000 million cubic feet of gas per annum, one-fourth of which was water gas. He had examined the water-gas plant at Bath; and it was practically the same as his own. It was in good condition; and he could find no trace of anything passing from the gas-works into the river. The water-gas plant was not then at work. He could see no trace of anything having passed into the river. In his opinion, the separator would be efficient in dividing the tar from the water. There was a great deal of iridescent matter on the surface of the river opposite the gas-works; and the next day he walked about a mile up the river, and saw a large patch of the same stuff above the bridge. He told Mr. Ellery, and they went up together in a boat to see it. He could not say what it was; but it looked like creosote. In his judgment, there was sufficient storage for the water-gas tar; and the system of utilizing it in the retorts was satisfactory. In his own case, they sold it.

Cross-examined: He used a different kind of coal to what they did at Bath. When he was at the works in June, the water-gas plant had been stopped for over a fortnight. He was satisfied the stuff he saw in the river did not come from the gas-works, because he could see no traces of it on the towing-path or at any of the outlets which were indicated to him by Mr. Ellery. He was much surprised to see the large patch of iridescent matter, as he had never witnessed such a thing on any other river. He made several experiments to see if he could reproduce the same effect. He thought it was caused by a back eddy in the river, acting on something which had got into it.

Re-examined: There would have been signs of tar on the effluent-pipes if it had come through there.

Mr. *Charles Gilbey*, Assistant-Engineer to the Bath Corporation, said he had often noticed iridescent matter floating on the surface of the river; but he had not traced it to any special source. On one occasion, he saw it rising from the bottom near a large sewer which ran into the river by the old bridge.

Robert Willis, foreman to Messrs. Gerrish and Co., carriers and wharfingers, Bath, said they had a wharf at Dorchester Street adjoining the electric light works. Last year he noticed a discharge of oil and grease from a sewer just at the bottom of their yard. It looked like dirty oil from engines, and sometimes showed colours. It got on to the cloths of the canal boats. The drain came from the electric light works. They had also found oil leaking into their stables from the electric light works; but on making complaint, it was stopped. Messrs. Gerrish carried a good deal of petroleum oil by canal boats in the winter; but the boats did not leak.

Cross-examined: They did not take much notice of the oily mess coming through the drain; it did not do them any harm.

Saturday, May 6.

Mr. *F. W. Stoddart*, F.C.S., was the first witness called this morning. He is an Analytical Chemist practising in Bristol; and he analyzed samples of water received from Mr. Ellery in July, 1898. They were labelled "From the bed of the river opposite the destructor works." The bottles contained water and mud, and from one Winchester quart he obtained 1·6 grains of a brown fluorescent hydrocarbon oil, which had a tarry odour. He sent it to Mr. Ellery in a bottle with ether, which had now evaporated, and only left a trace of the tarry matter on the bottle. Three smaller (4 oz.) bottles were labelled as having been taken from near the old bridge. From one of these bottles he obtained 76·4 grains of a light yellow carbon oil, with no smell of tar. There was also a soapy substance. In all the samples, there was a great deal of highly offensive matter, which rendered identification of the tar very difficult. In September he went on the river in a boat with Mr. Ellery. Between the railway bridge and the old bridge there was an iridescent film on the surface. Below the old bridge the film altered its character, and resembled a fatty scum. Lower down it again assumed a tarry appearance; and there were intermittent patches of this film all the way down. He disturbed the bed of the river in several places with a boat-hook, and blobs of iridescent matter rose to the surface. They were of a brown oily character, and had a tarry odour; and they spread out into a film, floated a little way down, and then contracted again and sank. There were many dead fish. Tar films were abundant all the way down to the lock near the plaintiffs' works. On returning up the river, he again disturbed the mud in several places above defendants' works, and in each case there were signs of tarry oil. There was a large lodgment of tar under the stones on the bank of the river just above the oil-gas plant. At one place a little higher up it was rather abundant, which he attributed to a waste steam-pipe which discharged on the surface of the water and disturbed it. He described several spots higher up where the deposit was large—some near the outfall of sewers. He put in one of the samples he took on this occasion. All contained a brown fluorescent tarry oil; but he could not say anything as to the nature of the tar, owing to the admixture of sewage and other matter. On the same day he inspected the gas-works, and did his best to discover any place at which tar or any residual escaped into the river; but he could find none. He did not analyze the effluent from the sulphate works on that occasion. On Feb. 23 of this year he again examined the river, and found the surface comparatively clean; there was more water. Half way between the old bridge and the Midland bridge, there was apparently oozing from the bank a quantity of light yellow oil. Some of this he collected, and found it to be of the same character as that which he had separated from the three small bottles in July. It caused an iridescent film on the water. About 200 yards above the plaintiffs' mills, he disturbed the bottom, and took samples, as well as near the ferry, and at the places where he had previously taken them. The appearances were similar to those he had seen before; and the analyses were the same, except the one where he saw the oil oozing from the bank. This had no tarry odour. In March he received samples of effluents from the separator and from the ammonia works. In one, there was a minute trace of tarry oil, not weighable or visible. That from the ammonia works contained no trace of oil or tar. The minute trace of the oil he found in the effluent could not, in his opinion, produce the effects he saw in the river.

Cross-examined: In the three large bottles he found oil of tarry odour; but he could not identify it as being a water-gas tar. The iridescence was not peculiar to water-gas tar. The three smaller bottles contained greasy scum rather than water. The oil he found in them was not, in his opinion, light illuminating oil, but heavy lubricating oil. He did not determine the specific gravity. He did not take any sample from below the works in September, 1898. He had no theory as to how the matter got into the bed of the river. He could not draw any substantial distinction between the places at which he disturbed the bottom, as regarded the quantity of matter liberated. At some places none was found. He was most successful where he displaced stones at the bottom. He had not identified water-gas tar in any sample; but his results above and below the gas-works were practically the same.

Re-examined: Coal-gas tar and oil-gas tar were easily distinguishable when reasonably pure; but when mixed with a lot of other matter, there was great difficulty in identifying them.

Mr. *Charles C. Spackman*, a Surveyor, of Bath, verified an Ordnance map on which were marked the various sewers which entered the river near the spot in question.

Justice STIRLING said it was admitted that all the sewage of Bath went into the river.

Mr. *Ellery* was recalled, at his Lordship's request, and asked how much tar was drawn from the separator on the 15th of March—the day on which he took the samples of effluent to send to Mr. Stoddart. He said it was 120 gallons. This was the day after the alteration was made in the works; but it would not affect the sulphate works for a week, as the water was drawn from a tank-well. The quantity of effluent was about 10,000 gallons a day.

This concluded the evidence.

Mr. BUTCHER then addressed his Lordship on behalf of the defendants. He pointed out that all cause of complaint had admittedly now ceased; so that the case for an injunction had gone, and the only question left was whether at the time of the writ the defendants were doing anything which caused damage to the plaintiffs. He submitted that they had failed to prove either that defendants had ever discharged water-gas tar into the river, or that the injury of which they complained was caused in fact by such tar. No piece of damaged cloth had been produced, nor evidence of any analysis of such pieces, to identify the cause of the damage. The learned Counsel proceeded to comment on the evidence at considerable length, and did not conclude his speech until after two o'clock.

After a short adjournment,

Mr. BEALE replied on behalf of the plaintiffs, and

His LORDSHIP reserved judgment.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Wednesday, May 3.

(*Before Mr. Justice* STIRLING.)

Windermere Gas and Water Company v. Crosthwaite.

In this action, the plaintiffs sought to restrain the defendant from taking up certain pipes under his land, and from interfering with the flow of water. The Company was incorporated in 1869, and by section 22 of their Act were authorized to make and maintain water-works, and for these purposes to enter upon and take and use certain lands, streams, and waters therein mentioned, and to impound, take, and divert the waters of the stream known as Dubb's Beck, and of its several tributaries, and all other brooks, streams, springs, and waters which then directly or derivatively flowed or proceeded into the beck. In pursuance of these powers, the plaintiffs constructed a reservoir, and diverted into it the waters of the above-named beck and divers tributaries thereof. One of these flowed through a close, known as the Grove Allotments, owned by the defendant. In pursuance of their statutory powers, the plaintiffs collected the waters of the tributary in a tank constructed under the roadway, and conveyed them from it in their mains direct to the consumers, without passing it into the reservoir, and without filtering. In October, 1883, the plaintiffs discovered that the waters of the tributary were much polluted while passing through the close; and, with the view of preventing this, they entered into an agreement with

the predecessor in title of the defendant, under which they constructed a covered conduit of earthenware pipes laid in the soil along the line of the natural watercourses. In 1888, defendant purchased the property by auction, subject to such rights of road or way, water, taking of water, or other easements, as then existed. Disputes having arisen between the parties, the defendant threatened to dig up the pipes under his land; and it was to restrain him from so doing that the action was brought.

Mr. PHIPSON BEALE, Q.C., and Mr. NORTON appeared for the plaintiffs; Mr. UPJOHN, Q.C., and Mr. CLARE for the defendant.

At the conclusion of the arguments, his Lordship reserved judgment.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Monday, May 1.

(*Before Mr. Justice* BUCKNILL, *without a Jury.*)

Crays Gas Company v. Bromley Gas Consumers' Company—A Boundary Question.

This was an application by plaintiffs claiming a declaration that a certain agreement made between them and the defendant Company was binding on the latter, and an injunction to restrain them from selling and supplying gas in any part of the parishes of Orpington and Farnborough other than that lying to the west of Lock's Bottom, Bromley Common.

Mr. LITTLER, Q.C., Mr. R. M. BRAY, Q.C., and Mr. CLARKE WILLIAMS appeared for the plaintiffs; Mr. CRIPPS, Q.C., M.P., Mr. DANCKWERTS, and Mr. VAUGHAN WILLIAMS represented the defendants.

Mr. LITTLER, in opening the case, said both Companies had parliamentary powers, and both obtained their Acts in the same year—1865—though the Crays Company had theirs a few days before the defendants. They both supplied gas in districts and parishes immediately adjacent to one another, and each had in their Articles of Association proposed to have in their Acts of Parliament an identical district and identical limits of supply. Naturally, under these circumstances, it became necessary that their respective positions should be defined; and on the 10th of November, 1864, the Bromley Company, having held a meeting and resolved to apply to Parliament for powers, instructed the Chairman of the Company to ascertain from the Secretary of the Crays Company (Mr. May) what their views were about going to Parliament. On the 16th of November a report was made to the Bromley Company showing that the Chairman had ascertained the willingness of the Crays Company to enter into a deed of arrangement defining the boundaries of their district. At the same time there was a notice of application by another rival Company, called the Kent Gas Consumers' Company. But the Kent Company later on agreed that they would not attempt to infringe on either district of the two Companies; so they got rid of them altogether. On January 18, 1865, Mr. May wrote to the Chairman of the defendant Company (Mr. Robinson Latter) with respect to the matter. The letter was in response to one received from Mr. Latter in December, in which he said: "I should like to see you about settling the districts of each Company." Mr. May wrote: "I shall be glad to hear from you on the subject of the district of your Company. If you will send a plan with what you propose, I will lay it before our Directors. It is time some definite arrangement was made, as, of course, the Crays Gas Company could not allow your Act to take all the district comprised in your Bill without some agreement is previously come to." The Crays Company then appointed two of their Directors to meet on the spot and settle the district; but the answer of the defendants was that they did not see any advantage in meeting on the spot. From that time nothing more was said; but Mr. May, who would be called, would say most distinctly that he met Mr. Latter, and an agreement in writing was entered into with regard to the subject. There was a certain amount of corroboration of this in the very provisions of the Bromley Gas Company's Act of that year, because clause 48 provided that the Company might from time to time agree in writing with any Company supplying or having power to supply gas within the limits of the Act, for determining the bounds beyond which one of the parties under such agreement should not supply gas without the consent in writing of the other parties; and any such agreement might be varied or annulled. It further provided that every such agreement made by the Company with any adjoining Company should be as valid and of the same cause and effect as if it had been made subsequent to the passing of the Act, but no further or otherwise. Therefore it was quite clear some agreement had been made at that time; and it was tolerably certain that there was no Company so intensely interested in the matter as the Crays Company in having some limits. This was the corroboration of Mr. May's statement that there was such an agreement. In effect, the agreement in question was actually acted upon; and in 1881 there was further correspondence with regard to the boundary of each Company. The plaintiffs had been asked to extend their mains from Chislehurst, and supply gas outside the district which had been defined; but the proposal was abandoned because no terms were come to. What stronger evidence could there be, Counsel asked, that an arrangement existed between the Companies, than this correspondence. Mr. May, in reply to a letter from Mr. Latter, wrote: "I will look up the boundary arrangement between the two Companies as requested;" and he wrote again saying he had not been able to find it, and was under the impression that Mr. Latter had a copy. Three years after—in 1884—the Bromley Guardians applied to the plaintiffs to extend their mains to the workhouse near Lock's Bottom, Farnborough—a place which, of course, used a good deal of gas. The Bromley Company had declined to do this; and the Crays Company accordingly arranged to make the extension, and furnish a supply of gas. They subsequently did so at considerable cost. Of course, they would not have gone to this expense if their position had not been clearly defined. In 1886, Messrs. Fox and Sons, a firm of brewers, also asked for an extension of the mains to their brewery; and this was carried out by the plaintiffs at a cost of £500. From that day onwards not a single word of protest or complaint had been made that the plaintiffs were intruding into the district which the defendants had the right to supply. The next thing was this: A survey was made by the Secretaries of the two Companies with Mr. Preston Davies, who prepared a map showing the geographical results of the terms of the agreement which the plaintiffs alleged had been entered into. In 1890, the Secretary of the Bromley Gas Company died, and another gentleman was appointed. There was some question as to the boundaries between the two Companies, and Mr. Woodward, the Manager of the defendants' works, wrote to the plaintiffs' Secretary on the subject. Mr. Latter was still Chairman, and he replied, saying that there was a proper sealed agreement defining each Company's district. Mr. Latter had since died; but fortunately Mr. May was alive, and he would say that this statement entirely confirmed his recollection, though he did not remember the seal. So matters went on until October, 1897, when there was a letter of complaint from the plaintiffs with regard to the defendants' encroachments. It recapitulated the whole history of the Companies, and pointed out that in 1884, a question having arisen as to the extent of each district—the defendants and the plaintiffs having the same parliamentary powers—certain negotiations took place with the defendants' late Chairman, which resulted in an amicable arrangement being arrived at. This, as he had explained, was in consequence of the gentlemen not being able to find the lost agreement; and the defendants said if there was a verbal agreement there could have been no written agreement before. The letter went on to state that the arrangement was entered into to prevent any competition between the two Companies which might result in the consumers playing off one against the other; and that it had been adhered to and observed from that time forward. He might point out that ever since the London Gas Companies' districts had been assigned to different Companies, no such thing as competition in gas supply had been recognized. After this letter, there was a long correspondence; but the defendants went on invading their neighbours' district. Plaintiffs therefore went to Mr. Justice Channell to obtain an injunction; and the matter was adjusted on terms which were satisfactory to the plaintiffs, and quite as good as an injunction. The consequence was that nothing more had been done up to the present time; and now the plaintiffs asked for a declaration and an injunction to restrain the defendants in the future. By their statement of defence, the defendants, of course, denied everything, and said they relied on section 48 of the Bromley Gas Act. So did the plaintiffs. Defendants further said that the agreements alleged, if made, were void in law and illegal, except so far as they were justified by the section cited, and they said the provisions of the section had not been complied with. But here they had an express statement by the defendants, through the recollection of their Chairman, that there was an agreement, and that it was duly sealed by both Companies. Further than this, it had always been acted upon. On two occasions in 1891 the defendants applied to the plaintiffs to know if they had any objection to their putting down mains in part of the district defined by the Act, and when the Companies could not come to an agreement, they absolutely abandoned any attempt to lay down the pipes. He submitted that this, in itself, would be conclusive; and after that, when there was an inquiry as to the agreement, there was a statement on the plaintiffs' part that it was in writing, which was corroborated by Mr. Latter. They had never invaded any part of the defendants' district, which was sacred to them; and they had never until lately attempted to touch plaintiffs' part. After his Lordship had heard Mr. May's evidence and seen the map, he (Counsel) thought he would hold that the plaintiffs were entitled to a declaration that an agreement did exist, and to an injunction to prevent defendants from departing from its terms.

Mr. CRIPPS said there would be a question whether the gentlemen referred to had power to bind either Company; but the more material point was that the defendants said no agreement had been made as was stated, and that at any rate the terms suggested by the plaintiffs as those of the agreement were not matters that were considered. As far as any division was discussed, it was about Chislehurst, and not about Orpington and Farnborough. That there was a discussion at that time was obvious.

Mr. *William May* was then called. He said he was a Solicitor, the first Secretary, and one of the originators of the Crays Gas Company. It was started by local gentlemen as a limited Company; and in 1865 they applied to Parliament for statutory powers. At that time the defendant Company was also in existence; and they went to Parliament at the same time. The three parishes—Chislehurst, Farnborough, and Orpington—were included in both Bills. Mr. Robinson Latter, who was also a Solicitor, was the Chairman of the defendant Company for many years, and witness was on very friendly terms with him. It was in 1865 that they had a meeting, and arranged the districts of the respective Companies; and he felt sure it was put into writing. But the plaintiffs' offices were changed several times, and the agreement must have been lost in the moving, because he had been unable to find it. It was acted upon for 33 years; and up to Mr. Latter's death there was not the slightest attempt to upset it. Until he heard it for the first time in Court, it had never before been suggested, to his knowledge, that the agreement only applied to Chislehurst. In 1884, when the question arose about laying the mains for the Bromley Workhouse in Farnborough, there was some correspondence, because the written agreement could not be found, and he had a meeting with Mr. Latter, and arranged the respective districts. Both he and Mr. Latter were well acquainted with the limits, and had always acted on their knowledge.

The map referred to was then produced, and explained by the witness to his Lordship.

Mr. CRIPPS, however, said he was instructed that they had nothing to do with it, and it must be shown that they were responsible for it.

Mr. LITTLER said it was actually mentioned by the defendants in one of their letters.

The further hearing of the case was then adjourned.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Wednesday, May 3.

(*Before Mr. Justice* MATHEW, *and a Special Jury.*)

Griffiths and Another v. Ilford Gaslight Company.

This was an action to recover damages in respect of the non-fulfilment of a statutory duty to supply gas.

Mr. HUME WILLIAMS, Q.C., and Mr. POYSER appeared for the plaintiffs; Mr. DICKENS, Q.C., and Mr. MACASKIE represented the defendants.

Mr. WILLIAMS said the action was brought to recover damages from the Ilford Gas Company for cutting off the gas under circumstances which he must characterize as of a rather high-handed nature. Mr. Griffiths some years ago was the owner of the Red Lion at Ilford. Towards the end of 1897 he sold the house to a Mr. White; one of the terms of the sale being that £6000 should remain on mortgage. White afterwards sold the house to Mr. Ferriss, and executed a mortgage for £6000 in favour of Griffiths. Ferriss, not being successful in business, was unable to pay the interest; and in September, 1898, Griffiths recovered judgment against him for £6000 and £72 arrears of interest. The money was not paid; and, after some negotiation, it was arranged that Ferriss should, on receiving £100, give up possession. On Oct. 14, notice was given to the Gas Company that the change was fixed for the 17th; and on that day an inspector took the state of the index, and made an entry that the meter was transferred to Griffiths. Gas was continued to be supplied in the ordinary way. Three days afterwards, a collector called with a demand-note for £56 18s. 9d; this sum representing the amount owing by Ferriss for gas supplied. Plaintiffs declined to pay, and consequently the gas was cut off.

Evidence was given by the plaintiffs and others, that the business of the house had been seriously injured by the action of the Company, and also as to the amount expended on oil-lamps, &c., during the time the supply of gas was withheld.

Mr. DICKENS argued that when the change took place the plaintiffs were neither "owners" nor "occupiers" within the meaning of the Act. When they became legal owners, and asked for a supply the Company, availing themselves of the provisions of their Act, agreed to furnish it on payment of a deposit of £25; interest being allowed at the rate of 5 per cent. If plaintiffs had been dissatisfied with this amount, they could have gone to the Justices and had it fixed; but, instead of doing so, they waited for two months, and then brought the present action.

Mr. *W. Ashmole*, the Chairman and Managing-Director of the Gas Company, said that when he saw Mr. Griffiths on the 21st of October that gentleman said he had taken possession of the house under a mortgage deed, but that the transfer would not be completed for a few days. He was never informed of the partnership between Griffiths and Easler, and had had no request to supply them as distinguished from Griffiths.

Mr. *J. Denney*, the Secretary of the Company, having given evidence, and Counsel having been heard,

His LORDSHIP left the following questions to the Jury: (1) Were the Company aware that Griffiths was in occupation on the 21st? (2) Did they refuse to supply Griffiths with gas unless the amount due from Ferriss was paid by Griffiths?

These questions the Jury answered in the affirmative, and assessed the damages at £50.

Thursday, May 4.

On the resumption of the hearing to-day,

Mr. DICKENS submitted, as a point of law, that the plaintiffs were not entitled to judgment. He said that, in view of the verdict, he must take it that the plaintiffs were the occupiers of the premises; but there was the question whether, having regard to what took place on the 21st of October, the defendants were deprived of the right they had under the Gas-Works Clauses Act, 1871, of having a written notice served upon them requiring a supply of gas. It was true that on the date named a verbal application was made, and that the Company imposed a condition precedent which they had no right to do. If this condition had been made in answer to a written application, the Company would be out of Court. Having called attention to the provisions of section 11, he submitted that the plaintiffs had not complied with the Act, and therefore could not recover.

Justice MATHEW was of opinion that a verbal notice would suffice if a written notice was waived. Section 39 made it perfectly clear that the Company could not fall back on the earlier section. The evidence was overwhelming that written notice had been waived. Judgment would be entered for the plaintiffs for £50, with costs.

Upon the application of Mr. POYSER, his Lordship certified that it was a proper case to bring in the High Court.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Monday, May 1.

(*Before Justices* DARLING *and* CHANNELL, *sitting as a Divisional Court.*)

Brock v. Harrison—A Question of Liability.

Mr. MONTAGU LUSH appeared for the appellant; Mr. MACMORRAN, Q.C., and Mr. SHEARMAN represented the respondent.

Mr. LUSH said this was an appeal on a case stated by the Stipendiary Magistrate of the Staffordshire Potteries Court at Stoke-upon-Trent; and it raised the question of whether, where water was supplied by a Company to the occupier of a house under £10 rental value, and the owner was liable for the water supplied, if the pipes and cisterns got out of order and the water was wasted, the owner or the occupier was the person against whom the proceedings would lie. He would first read the case which was stated by Mr. Harold Wright, the Magistrate for the Staffordshire Potteries district, under the provisions of the 20 and 21 Vic., chap. 43, for the purpose of obtaining the opinion of the High Court on a question of law: At a Court of Summary Jurisdiction, sitting at the Town Hall, Stoke-upon-Trent, on Nov. 25, 1898, an information was laid by Mr. Geo. D. Harrison, Engineer to the Staffordshire Potteries Water-Works Company, against Sarah Brock, charging her that she, on "the 28th of October, 1898, at a house, No. 105, Lower Hartshill, in the county of Staffordshire, then being supplied with water by the said Company, did unlawfully and negligently suffer a certain pipe to be out of repair, so that the water supply to her was wasted contrary to the provisions of the statute in the case made and provided." The parties were represented by solicitors; and upon the hearing the appellant, Sarah Brock, was duly convicted of the offence, and was fined £5 and costs. The appellant, being dissatisfied, asked for a case to be stated. The facts were that the appellant was the owner of a house, No. 105, Lower Hartshill; and Mr. Beech was the tenant. The house was let at a weekly rental of 3s. 0½d.; and this included the water supply. The Staffordshire Potteries Water-Works Company supplied the water; and the appellant, as owner, paid for it. The appellant's name only, and not the name of the tenant, appeared in the books of the Company as the person liable for the water-rates; and the appellant was the person who received the rent. For eight weeks certain service-pipes belonging to the appellant, and used in the house, were out of repair, and caused considerable waste of water. The appellant personally called at the house for the rent; and from time to time the tenant drew her attention to the condition of the pipe and the subsequent waste of water. The tenant made some attempts to prevent this waste, but failed to do so. The appellant did not cause the pipe to be repaired; and the leakage being brought to the notice of the Water Company, the supply was stopped, and action was taken. Upon this evidence it was contended by the appellant's Solicitor that she was not "the person supplied with water" within the meaning of clause 51 of the Staffordshire Potteries Water-Works and Consolidation Extension Act of 1883, but that the tenant was the person supplied; and that the appellant paid for the supply only by reason of section 72 of the Water-Works Clauses Act of 1847, which provided that where a house was rented at under £10 the landlord should pay the rates and taxes. It was therefore argued that the appellant was not liable. The Magistrate held that the appellant was properly charged as the person supplied with the water within the meaning of section 51; and he found that she negligently suffered acts so that the water supplied by the Company was wasted. He therefore convicted her. The general question of law was whether, upon the statement of facts, the Magistrate came to a correct conclusion in point of law in holding that the appellant was the person supplied with water within the meaning of the Act. Counsel now said that the finding of the Magistrate, that the lady had been guilty of negligence, though no doubt proper in his view, begged the question, because it all depended on whether she was the person whose duty it was to repair. The point was a short one—What was the meaning of the words "the person supplied with water"? He should have thought the words "supplied with water" would refer to the person who used the water; and if this was a true view, the tenant, and not the owner, was the person liable.

Justice DARLING: But when a butcher supplies meat which is eaten by a servant, is the servant the person liable to pay?

Mr. LUSH replied that the occupier whose servant eats the meat, and not the owner of the house, was liable. Resuming, he said the question remained whether the tenant was the person who was liable for the supply, or whether the owner who did not touch the water was in fact to be called "the person supplied with water." The Company did not seem to see that they were in a serious difficulty, for this reason: Though under the Act the mere fact that anyone allowed water-pipes to be out of order made him liable to conviction, yet this had been altered by the Public Act now in force; and it was to be put on the same footing as the Special Act, where the "negligent or wilful conduct of the person supplied" was essential to make an offence. If the view of the Company was allowed, they would have no remedy against negligence. They could not hit the tenant, because they said the owner was liable; and they could not hit the owner, because in the vast majority of cases he could not possibly be guilty of neglect or misconduct. Therefore the person who was to be hit, was the person who was not liable at all for the condition of the pipes.

Justice CHANNELL: I should have thought that the tenant in this case, if he wilfully turned on his tap for 24 hours, might be hit as "a person supplied with water"—but who wilfully wasted it—notwithstanding that the landlady might also have come under the section.

Mr. LUSH said the question of negligence did not really matter, because they must first show that it was the person supplied with water.

After some further conversation,

Justice DARLING said it would not be necessary for the other side to address the Court. In this case the appeal must be dismissed. He thought the Magistrate was perfectly right in holding that the owner of the house came within the definition of "any person supplied with water." He was far from saying that the owner of the house was the only person supplied with water; but she was a person supplied, and therefore the conviction was right.

Justice CHANNELL agreed. He said that in his opinion the appellant was "a person supplied with water;" but he was not sure that the Magistrate should have found she was "the" person supplied with water. However, he was mainly right; and therefore the appeal would be dismissed with costs.

HIGH COURT OF JUSTICE—QUEENS' BENCH DIVISION.

(*Before Mr. Justice* BRUCE.)

Wednesday, May 3.

Welsbach Incandescent Gas-Light Company, Limited, v. Dowle and Others.

This was an action for an injunction to restrain the defendants from infringing plaintiffs' letters patent, and from selling any mantle bought from the plaintiff Company for use upon, or in connection with, burners not of the plaintiff Company's manufacture. The plaintiffs alleged that defendants had purchased incandescent mantles, constructed in accordance with plaintiffs' patent; and that these mantles were distinctly sold upon the terms and conditions printed on the box—viz., that plaintiffs granted a "limited licence to the purchaser to use or sell the same, on the express condition that neither the purchaser nor any other person into whose hands the same may come shall use and sell the mantles except in connection or for use with burners sold or supplied by the Company." In November, 1897, the defendant, or his predecessors in business, at their premises No. 24, Hatton Garden, sold to Mr. W. J. Moore a complete burner for incandescent gas lighting, consisting of a mantle of plaintiffs' manufacture and a burner which was not of the manufacture or merchandise of the plaintiffs, in breach of the condition imposed upon purchasers. Other cases of sale and purchase were also alleged; one being at a stall at the Alexandra Palace. The defendants denied the alleged infringement.

Mr. TERRELL, Q.C., and Mr. A. J. WALTER appeared for the plaintiffs; Mr. LEWIS EDMUNDS, Q.C., and Mr. MOYSES represented the defendant.

The evidence given occupied a considerable time, and was of a conflicting character. It was dealt with by the learned Judge in giving

judgment (as he did the following morning), and need not therefore be given in further detail.

In giving judgment in the case,

Justice BRUCE said he thought the action failed. It was brought for an alleged infringement of the plaintiffs' patent rights. The particulars of breaches alleged that the defendants purchased the plaintiffs' mantles on certain terms and conditions; the substance of the complaint was that the defendants sold the mantles in breach of these conditions. In support of the plaintiffs' case, Mr. Moore, who was employed by the Company, said he went, in November, 1897, to the defendants' place of business, No. 24, Hatton Garden, and asked for a complete incandescent burner. He said that the burner supplied was not one of the plaintiff Company's manufacture, but that the mantle was. He said that he handed the burner and mantle to the plaintiffs; but it seemed to have been mislaid. At any rate, neither mantle nor burner was produced. The witness was unable to specify the date of the transaction; he could not remember whether he received an invoice, or what price he paid; he could give no description of the person from whom he purchased, except that she was an elderly female; and he did not remember whether he asked for a white mantle or not. He could not regard this as satisfactory evidence to establish a sale in breach of the conditions. The best evidence of the character of the articles sold would be the articles themselves; and their non-production, without any explanation or excuse, constituted a material defect in the plaintiffs' proof. Moreover, assuming that the burner sold was not one supplied by the plaintiffs, and that the mantle was theirs, still the mantle might have been supplied to be used with a burner of the plaintiffs, when there would have been no breach of the conditions, because it was consistent with the terms and conditions that mantles might be supplied apart from burners, if they were to be used with such burners. Plaintiffs sanctioned the supply of mantles for the purpose of renewal. Whether a mantle was or was not supplied to be used with the plaintiffs' burner might depend—and in many cases must depend—on the conversation which took place at the time of the sale; and when a witness was unable to recollect whether he asked for a white mantle, and could not say the price paid—which would be some indication of what the mantle was—he (the learned Judge) could not regard his memory as sufficiently accurate to justify him in accepting his evidence as establishing the case. The only other instance of alleged infringement prior to the writ, related to a transaction on April 5, 1898; and in regard to this there was conflict of evidence. Mr. Lacey, on behalf of the plaintiffs, said he went to the shop in Hatton Garden and asked for a complete burner. The burner was packed up by the assistant, Miss O'Hare, without a mantle; and when it was ready he paid for it, and a receipt was given him for 3s.—charging him for the burner and mantle, although no mantle was in the packet. There being no Sunlight mantles in the shop, he waited while Miss O'Hare sent a boy to get the Sunlight mantles. Having waited some time, as the boy did not return he looked round, and seeing some Welsbach mantles asked Miss O'Hare if the boxes he saw contained mantles. She said they did, but that if he wanted one of those he would have to pay 6d. extra. Witness said that no conversation took place with regard to the conditions under which the mantles could be used. Thereupon a Welsbach mantle was put into the parcel, and the invoice altered by striking out the figure 3s., substituting 2s. 3d. for the burner, and adding 1s. 3d. as the price of the mantle. Miss O'Hare contradicted this statement. She said that she supplied a Sunlight burner and mantle; that she did not pack up the burner without the mantle, but the two together; and that she received the 3s., and made out the invoice accordingly. She denied that Lacey waited in the shop, or that she sent the boy out for the mantles. She said that when she had packed the burner up Lacey asked her what mantle was supplied; and she said a Sunlight. He then said: "Oh! that is red. I want a white one;" and she then told him that if he had a Welsbach mantle it was not to be used with the burner which she had supplied. He replied that he had Sunlight mantles, and that the Welsbach mantle was for another burner. She then deducted 9d. from the bill for the Sunlight mantle, and added 1s. 3d. for the Welsbach. If Miss O'Hare's evidence was correct, it was clear there was no breach of contract, as she distinctly informed Lacey that the mantle was only to be used with a Welsbach burner; and according to her evidence, he said he had a Welsbach burner, and wished to use the mantle on that. In this conflict of evidence, it was difficult to decide. On the one hand, it might be said that Lacey was an inquiry agent in the service of the plaintiffs, and inclined to put upon the facts a complexion which would best suit the interests of his employers; on the other, that Miss O'Hare would be willing to overlook any irregularity of conduct on her own part which might get her employer into difficulty. He must decide upon the probabilities of the case; and he was very much guided by the statement with reference to the invoice or receipt. It seemed improbable that Miss O'Hare should have packed up the burner without putting in a mantle, and that she should have made out a bill and been paid for it if the mantle was not contained in the parcel. It was more likely, on the whole, that her story was correct; and therefore he did not find sufficient evidence to justify him in coming to the conclusion that there was any infringement before action. It was contended that he should attach value to the evidence regarding acts done after the issue of the writ. He had received the evidence because, as the case was tried without a Jury, he thought this was the more convenient course. But after consideration, he was of opinion that such evidence was not admissible; and therefore he must disregard it. In that he was guided by the opinion of Mr. Justice Romer, in the case of the Shoe Machinery Company, Limited, in which he considered the matter very carefully, and reviewed the cases which had a bearing on the question. He quite agreed with his decision, that in an action for infringement evidence ought not to be admitted to prove acts done after the issue of the writ; but in any event he was bound by it. When he admitted the evidence, he was inclined to think that acts of infringement before action were proved; and then, in order to show a course of continued unlawful trading, evidence might be given of acts done after action, in order to negative any presumption that the former acts were merely accidental or unintentional. But Mr. Justice Romer's decision prevented him taking this view. Again, even supposing the evidence to be admissible, he did not think he ought to attach much weight to it. There was the evidence of Mr. Williams, the Accountant to the plaintiffs, who said that on May 28, 1898, he went to the Alexandra Palace, where the defendants had a stall. He saw two kinds of burners there, and asked the price. On hearing there was a difference, he asked the reason, and was told it was owing to the mantle—the white one being the more expensive. He then inquired if he could have a white mantle and the cheaper burner; and the man who served him—who appeared to have been the defendant—said he was not supposed to sell the cheaper burner with the other mantle. To do so, he remarked, would be an infringement, but he did not suppose the Company troubled themselves to look after these things in private houses. Even if this stood alone, it would be difficult to say that at the time the mantle was sold he did not inform the purchaser that he could not supply the plaintiffs' mantle unless it was to be used on their burner, and that to do otherwise would be an infringement. Mr. Dowle said distinctly that he had always given express instructions that no sale should be made contrary to the conditions; and he denied that he was ever a party to any such sale. Here, again, he did not think it would be satisfactory to act on such evidence, even if it could be received. It depended entirely on the exact words used; and it would be difficult to say, even on Mr. Williams's account, that the article was sold without notice that it was an infringement of the patent to use it otherwise than in connection with a Welsbach burner. The only other point he need consider was the evidence of the witness Barnett, as to something that occurred on Aug. 5, 1898; and he could not attach any importance to this, because no notice whatever had been given to the defendants which would have enabled them to meet or explain it. There was a matter to which some importance was attached by Mr. Terrell—viz., the invoice which contained items of 2 dozen mantles at 5s. (which were said to be Sunlight); 1 dozen common burners, 5s. 6d.; and 1 dozen Welsbach mantles, 10s. It was said that this showed a sale of the plaintiffs' mantles in conjunction with common burners. But no evidence had been given with reference to the circumstances under which the goods were sold; and the mere production of a document of the kind, including Welsbach mantles, which might have been used for legitimate renewals, was no evidence of infringement. He must therefore dismiss the action with costs.

The Welsbach Patents in Australasia.

In August last, the Australasian Incandescent Gas-Light Company, Limited, commenced an action against Messrs. Brandt Bros., of Melbourne, to enforce the restrictive conditions under which all their mantles are issued. Judgment was given in the action in the Supreme Court of Victoria on the 15th of March; an injunction being granted restraining the defendants, their servants or agents, from using or selling for use any mantle, or attaching to a burner any mantle, in breach of the following conditions: "That neither the purchaser of, nor any person into whose hands any such mantle may come, shall use the same, except with burners which shall have been supplied by the Company; that no such purchaser or person shall attach any such mantle to any burner which shall not have been supplied by the Company; that no such purchaser or person shall sell any such mantle, except for use with burners which shall have been supplied by the Company." The judgment also directed an inquiry as to the number of burners sold by the defendants since the restrictive conditions were imposed, and upon which the mantles subject to these conditions had been affixed. The defendants were ordered to pay damages at the rate of 6s. for every burner upon which the mantles subject to the conditions had been affixed, and, further, the sum of £140 towards the plaintiffs' costs.

The Assessment of Shops for Water Supply in Scotland.

Sheriff Johnston, of Forfar, has lately decided an appeal on the above-named matter, which came before him under the following circumstances: A number of shopkeepers in Kirriemuir appealed to the Sheriff Court against the action of the Police Commissioners of the burgh in levying the special water-rate upon their full rentals, instead of, as contended, upon one-fourth of the rental, as provided by the terms of the 267th section of the Burgh Police (Scotland) Act. The appeals were heard in the first instance by Sheriff-Substitute Lee, who found for the appellants, and awarded them expenses. Sheriff Johnston has reversed this decision, and has sustained the contention of the Commissioners. He finds that, in imposing the assessment, they made no discrimination between shops and other property; that the assessment was properly laid under the Public Health Act; and that to the assessment section 267 of the Burgh Police (Scotland) Act does not apply. In a note, his Lordship observes that this is another example of the chaos which exists in all matters statutory in burghs which have the misfortune to come under the provisions of the Burgh Police Act, 1892; and in this case the chaos is increased, not diminished, by the Public Health Act, 1897. The former Act, under which Kirriemuir is now placed, gives power to provide water; and section 267 says that with respect to the supply the provisions of certain clauses of the Water-Works Clauses Acts shall be incorporated—"provided always . . . that for shops the water-rate or portion of the burgh general assessment applicable to water shall be charged only on one-fourth of the rental of the premises, unless, in special circumstances, the Commissioners see cause to charge the ordinary rate." The question now raised was: Did the provision regarding shops apply (1) to assessment for water supply already provided; or (2) only to assessment for water to be provided after 1892, and under the provisions of the Burgh Police Act, 1892? From its collocation, he should say *à priori* that it was meant to apply to the case for which the provisions of the Water-Works Clauses Acts were incorporated—that was, to assessment for new or further supply of water. At the same time, one would naturally have expected that the General Act of 1892 would have intended and attempted to make a complete code of municipal law and rating, and not have left the old public health assessment to run on concurrently with the new system of burgh assessments; but he did not think this had either been intended or attempted.

The Stockport Corporation have accepted tenders for cast-iron gas-mains from Mr. James Ritchie, of Middlesbrough, as follows: £5 15s. for 3-inch, £5 10s. for 4-inch, £5 7s. 6d. for 6-inch, £5 3s. 6d. for 8-inch, and £9 5s. or irregulars. There were thirteen tenders sent in.

MISCELLANEOUS NEWS.

IMPERIAL CONTINENTAL GAS ASSOCIATION.

The Half-Yearly Ordinary General Meeting of the Proprietors of the Association was held last Tuesday, at the Cannon Street Hotel—Mr. T. H. Goodwin Newton presiding.

The Secretary (Mr. R. W. Wilson) read the notice convening the meeting, and subsequently the following report of the Directors:—

The present half-yearly ordinary general meeting of the proprietors has been convened, in conformity with the Associ:ation's Acts of Parliament, for the purposes of receiving a report from the Directors upon the affairs of the Company, and of declaring a dividend for the half year ended Dec. 31, 1898.

The following summary shows the result of the Association's operations during that period: The quantity of gas made in the half year ended Dec. 31 last was 4672 million cubic feet. The quantity made in the corresponding half year of 1897 was 4949 million cubic feet—a decrease of 277 millions, or at the rate of 5·6 per cent. This decrease is, of course, entirely due to the cessatio.1 of the Association's operations at Amsterdam, where, in the corresponding half year, the gas made amounted to 546 million cubic feet. A comparison of the results at the other stations exhibits an increase of 5½ per cent. in the quantity of gas sold, and shows that, in the short period of six months, they have made good over 44 per cent. of the loss at Amsterdam.

The total number of lights on Dec. 31 last amounted to 2,591,097. At the close of the corresponding half year the number of lights was 2,669,624, which gives a decrease of 78,527, or at the rate of 2·94 per cent.; but, allowing for the loss of 276,351 lights at Amsterdam, the rate of increase at the other stations is slightly over 8 per cent. The entire length of mains on Dec. 31 last was 1928 miles. The length of mains on Dec. 31, 1897, was 1960 miles—a decrease of 32 miles. The figures for 1897 include the mains at Amsterdam, which had a length of 192 miles. The increase in the mileage of mains during the year at the other stations is therefore 160 miles. The number of the Association's consumers on Dec. 31 last was 217,200, or only 2387 less than on Dec. 31, 1897, on which date there were 22,528 consumers at Amsterdam.

The plant and mains at all the stations were maintained in a due state of efficiency.

A comparison of the statistics of the half year as regards the receipts and the profit upon the workings is, owing to the loss of Amsterdam, of no practical value; but the Directors are pleased to be able to state that the progress indicated at the other stations in the volume of the gas made and sold is equally reflected in the receipts and profit.

The average cost of the coal delivered upon the works was 4¾d. per ton more than in the corresponding half year; but, owing to the decreased values of both coke and tar, the net cost of the coal exhibits an increase of about 7¼d. per ton. A gratifying improvement has taken place in the value of sulphate of ammonia; and the revenue derived from the sale or treatment of ammoniacal liquor shows, notwithstanding the cessation of operations at Amsterdam, a considerable increase.

On Aug. 10 last, the arrangements for the transfer of the Amsterdam station to the Municipality were carried out without the slightest hitch. The Association has received, on account of the Amsterdam capital, the sum of £1,360,087. This has been invested and otherwise utilized; and the interest received, together with the profits made at the stations and the revenue derived from other sources, bring the profit of the Association for the half year under review to a higher figure than that of the corresponding period of 1897, when the Amsterdam station was still in full work.

Satisfactory progress was made with the new offices and show-rooms in the Place de Meir at Antwerp. At Berlin, the Directors' anticipation of a considerable increase in the consumption of gas was realized; and the need of the extensions, particulars of which have been reported to the proprietors, was fully demonstrated. The Directors had before them the question of the best means of utilizing the site purchased at Mariendorf—a suburb south of Berlin—for a large new works. The erection of the steel three-lift gasholder on the Forest Works, Brussels, was proceeded with. At Frankfort-on-Main, the eight benches of inclined retorts on the Bockenheim works were completed, and put in action with satisfactory results. At Haarlem, land for which the Association had no further use was sold on advantageous terms. At Lille, a piece of land adjoining the St. André works was purchased.

The Directors have to report the acquisition of the following gas-works and concessions: Brüx, Saaz, and Graslitz, in Bohemia, and Neutra in Hungary. The number of cities and towns now lighted directly by the Association amounts to 32.

The Directors have to report that they have dealt with the surplus resulting from the return of capital at Amsterdam in the manner suggested on the occasion of the last half-yearly meeting. This surplus amounts to £369,353 18s. 8d., and appears in the balance-sheet of Dec. 31 last under the head of dividend equalization account.

The Directors have the pleasure to report that, on Oct. 7 last, the Town Council of Vienna adopted, in their entirety, certain proposals of the Gas Commission, which included the acceptance of terms offered by the Association; the most important being that a unified contract for the supply of gas to the outer districts of the city should be concluded with the Association up to December 31, 1911. Other terms are the purchase by the Town Council of the meters in the inner districts to be lighted by them after Oct. 31 next; the withdrawal of all lawsuits pending between the City and the Association, and the purchase by valuation at the termination of the new suburban contract of the system of mains, services, lamps, and meters, but not of the Works serving the outer districts.

The Directors desire, in conclusion, to draw the attention of the Proprietors to the accounts for the half year ended Dec. 31 last. These have been duly audited; and from them the Directors have, in accordance with the provisions of the Companies' Clauses Consolidation Act, prepared a scheme showing the profit of the Association for the half year, and the portion thereof applicable to the purposes of dividend, which they recommend now to be declared—viz., a dividend of 5 per cent. for the half year ended Dec. 31 last, payable, free of income-tax, on and after Tuesday, the 9th inst.

The Directors who go out of office by rotation are: the Hon. E. C. Leigh, C.B., Q.C., J. Horsley Palmer, Esq., Robert Tindall, Esq. These gentlemen are eligible for re-election, and offer themselves accordingly. The Auditor who goes out of office by rotation is Sir Joseph Sebag Montefiore, who is eligible for re-election, and offers himself accordingly.

The Chairman moved—"That the report of the Directors upon the affairs of the Association, which has been read, be received, adopted, and entered upon the minutes."—In doing so, he said he would for a few minutes dwell upon the things which struck him in the report, and also refer to events which had occurred since its conclusion at Dec. 31 last. First of all, alluding to the manufacturing results, the proprietors would have noted that there had been an increase in the prime cost of their great manufacturing material coal, the effect of which in the half year under review was intensified by the smaller amount received for the principal residual, coke; and this was so notwithstanding that, by improvements in plant and engineering skill, a larger quantity of coke per ton of coal carbonized was left for sale when that used as fuel had been deducted. The increase in the prime cost of coal, though small in itself, acquired significance when it recurred, as it did, half year by half year; and it promised, he was sorry to say, to have a still more marked effect upon the manufacturing profits in the current half year than in that under review. To all appearance, the volume of the business of the Association, whether tested by the gas made, the gas sold, or by the number of the consumers, would within eighteen months of the loss of the first-class station of Amsterdam have entirely recovered itself. And what came home with more force to all of them than did this statistical statement was that the profits at the stations, with the interest on investments, were, as stated in the report, greater in the past half year than in the corresponding period of 1897; and he might add that the amount of the station profits and interest was really greater than it had ever been in any corresponding half year in the history of the Association. The Directors might challenge without fear their selection of temporary investments for the large capital sums withdrawn from the proper business of the Association through the payment by the Town Council for their works at Amstersdam. With regard, too, to the selection of investments for the reserve fund, to which he alluded at the last meeting, he was now perfectly satisfied, notwithstanding what might have been said by previous occupants of the chair, that this selection was within the proper functions of the Board, so long as the investments were made outside the Association's business; and this might in the near future be acted upon by the Board. The Directors had not, nor would they, relax their efforts to re-employ in the proper business of the Association, when this could be done to the advantage of the proprietors, the capital in temporary investment, although, as the report pointed out, there were already 32 towns directly lighted by them; and he might add that this meant the administration of above 100 contracts for gas, electric light, and for both, which might occupy the attention of as many Boards. These contracts were spread over an enormous area, were drawn up in various languages, and involved accounts in various currencies. At Antwerp, it might be well to pause for a moment, and consider the influence of competitive sources of lighting upon one another. As to the electric light, it was not a competitor with gas as an economical source of light; a unit of light produced electrically being at the best far more costly than a unit produced by gas. In fact, the competition of the electric light with gas was far more apparent than real. But there were, of course, special cases where the electric light was of undoubted value; and where there was a substantial public demand for the light, it went without saying that a public supply would follow. But even in cases where the Gas Company would be allowed to supply the demand, it could easily become a question of good policy whether they should do so; and at Antwerp the Directors were willing that the supply of electricity should be in other hands. The real competitor with gas there was petroleum, which was cheap, and the lamps used were good. Of course, this competition between gas and petroleum was most felt in small houses; and in order to secure the dwellers in these houses as consumers of gas, the Directors had introduced good prepayment-meter installations. As a result, last year nearly 3000 users of petroleum came over to gas in that one town. But the Board were not satisfied that the consumption of gas generally at Antwerp was what it should be; and they were therefore trying in the current half year what effect a voluntary reduction of the price there by some 10 per cent. might have. The Directors reported last November having obtained concessions for fifty years from Jan. 1 last for the lighting of three more suburbs to the north and north-east of Berlin. The public lighting of these suburbs was commenced some time before the dates stipulated in the contracts, and the general lighting was now well advanced. The office accommodation at Brussels, which was well placed for the business of the Association when they lighted the centre of the town, had become inadequate and unsuitably situated now that the operations of the Association were in the suburbs. They had, therefore, in the current half year acquired premises in a leading thoroughfare, which would be adapted to the various purposes of new offices, show-rooms, and workshops. During the present half year, two new suburban contracts had been concluded there; and the electric lighting undertaking was now in process of being inaugurated. Here they had the case of a town the lighting of the centre of which they lost 25 years ago, and now the gas consumed in the suburbs which they lighted was as much as the gas then consumed both in the town itself and in the suburbs. Mr. Masjon, their Chief Engineer at this station, had recently retired; being succeeded by Mr. Salomons, lately Chief Engineer at Amsterdam. Mr. Masjon was an officer of the Association for 42 years, the last 20 of which were spent as Chief Engineer at Brussels, and he had been pensioned with due regard to the long services he had rendered to the Association. Regarding Lille, he (the Chairman) must also refer to recent changes in the staff there. Less than five years ago, Mr. De Vigne died, after having been twelve years Chief Engineer at this station. He was succeeded by Mr. Edouard Melon, who resigned from ill-health in October last; and Mr. Robert Pauli (a comparatively young man, but with a long record of service with the Association) was promoted to his place. Unhappily, he carried with him the seeds of a fatal disease, which had not allowed him to enjoy for many months his well-earned promotion. In view of the peculiarities of the varied interests of the Association at Lille, which the Board had to take into consideration when making an appointment to the position of Chief Engineer there, they had now chosen for the post a distinguished outside Engineer in the person of Mr. Emile Delebecque, formerly an Engineer of the Northern Railway of France. He was a Professor of the Industrial Institute of Lille, and President of the Committee on Civil Engineering of the Industrial Society of the North of France. He (the Chairman) trusted in his hands the varied interests of the Association at Lille would be safeguarded for many years to come. The last, but not the least interesting, topic in what he wished to say to the proprietors on this occasion would be a brief reference to Vienna, and in connection

with it the shortest possible summary of what he took to be the position of the Association at the present moment. The arrangements with the Town Council in October last, which he had the pleasure of announcing at the last meeting, were formally recorded in the report which had been read; and now he had the great pleasure of announcing the receipt of a telegram from Dr. Teltscher, of Vienna, saying that the agreement arrived at in October had taken the form of a signed contract between the parties. He (the Chairman) might add that the obligations imposed on the Council by the agreement had been loyally fulfilled by them. The position thus attained at Vienna under this new contract was that on Nov. 1 next the Association would commence a new era there with a contract in the progressive outer districts, which at the outset commanded such a large number of consumers and such a substantial rental that it approached, in its annual value to the proprietors, to that of the contract lost at Amsterdam in August last. One word in estimate of the position of the Association in view of the crisis which they were now approaching; and he trusted that no pardonable pride which he might feel on account of any share he had had in the creation of the position which the Board had been so fortunate to obtain in the interests of the proprietors would lead him to overestimate the position one iota, and that the sense he certainly felt of the magnitude of the loss they were about to suffer at Vienna would unduly depress his estimate. This loss was not a contraction of business at one station which a year or two's expansion of business at other stations could rectify, nor would it be accompanied by the payment of capital sums of exaggerated proportions in comparison with the net profit of the station at Amsterdam. As to dividends, he repeated that they might expect, through the careful provision of the Board, that, unless any unforeseen accident occurred, such as a European war, they would pass through the crisis paying the highest rate of dividend the Association had ever paid. Bonuses he did not refer to, as in their nature they fluctuated. If it was considered that the annual value of the new contract at Vienna might be set against the loss at Amsterdam, there remained for consideration how, when, and to what extent they could recoup the loss of the inner districts of Vienna? As the proprietors knew, the Association had in hand a large sum from Amsterdam; and a satisfactory commencement had been made with the realization of assets at Vienna—and not at demolition values, for they were not doing so in a panic, but with capital in hand for all their present requirements. From the experience of the Town Council at Vienna, the total of the capital sums he had referred to would not suffice to build and equip works to earn the lost profits there, even if they had a new Vienna to go to. Such part of the total as might be expended on the extension of their existing works in populous places should, of course, yield a proper manufacturing profit. Such parts, however, of the total as were expended in suburban districts with scattered populations could not certainly at first be expected to earn such a rate of profit; neither could such parts as were expended on the acquisition of established concerns be expected at first to do better. He felt that the proprietors had in the Association a good and stout ship, and so long as they had confidence in the captain and crew in whose hands they placed her, so long had he every confidence in the future of the Association.

Mr. J. Horsley Palmer seconded the motion.

Mr. Yeld asked whether the Association were lighting the Opera House at Vienna by electricity.

The Chairman replied that they were; but it was quite independent of the contract there.

The motion was unanimously carried.

The Chairman next proposed, and Colonel Wilkinson seconded, the declaration of a dividend of 5 per cent. for the half year on the £3,800,000 capital stock, free of income-tax.

The proposition having been agreed to,

The retiring Directors and Auditor (named in the report) were re-elected.

Sir Joseph Sebag Montefiore said that, although formality demanded that he should ask the permission of the Chairman to propose the resolution which he was about to read, he did not invite the support of the Chairman nor of his colleagues thereto, but he addressed himself entirely to the proprietors. He believed, if he were to immediately read the resolution, it would be sufficient for the business; but he did not consider it would be either appropriate or respectful were he not, in introducing the resolution, to make a few preparatory observations. Perhaps he would do well to at once read the resolution. It was: "That, in accordance with the unanimous recommendation of the Committee appointed to consider the matter, the sum of £5000 be voted to the Board of Directors of the Association in recognition of the additional, and very important, labours they have recently undergone in connection with the Amsterdam and Vienna stations, and which have been followed by such gratifying success." It would be in the recollection of the proprietors that, at the last half-yearly meeting, it was unanimously resolved to delegate to a Committee the consideration and the recommendation of the recognition that should be made to the Directors for the services he had mentioned. He thought it right he should tell the proprietors that, immediately after their last meeting, the Committee assembled at the offices; and he (Sir Joseph) had the honour of being appointed Chairman. They had the advantage of the presence of the Secretary, Mr. Wilson, who very readily—he might say spontaneously—afforded them every information with regard to the duties of the Directors, the frequency of their attendances, and the remuneration which they were receiving; and he believed Mr. Wilson satisfied every member of the Committee on these points. Next they had to address themselves to the form the presentation should take. It was considered whether it would not be quite as well to offer a piece of plate to each member of the Board; but it was decided that the easiest, most useful, and acceptable way would be to vote a lump sum to be divided among them. He then begged his colleagues to consider what the amount should be; and they were all most anxious, while desirous of recognizing not alone the importance of the services which had been rendered to the Association, but also the position in the City of London which each member of the Board occupied, that—and he thought this would be in accordance with the views of the proprietors—they should offer a generous amount, while not leaning too much to what he might call excessiveness or exaggeration. Although it fell to his lot to propose the sum which he had mentioned, he must say that the feeling was unanimous on the part of the Committee that this was an appropriate amount—leaning not too much to the side of parsimony or to the side of generosity. It was a pleasing thing for them to be unanimous on this point; for he believed, although he had not spoken a word on the subject to any member of the Board, that, unless the recommendation had been unanimous, and unless the recommendation of the Committee was accepted by the proprietors with unanimity (as he believed it would be), the gift would not be agreeable to the Directors.

Mr. J. Gurney Fox, in seconding the motion, said he was glad to have this opportunity of expressing his appreciation of the Directors of the Association both collectively and individually for the splendid services they had rendered. His only regret was that his brother, Mr. Robert Fox, who, at the last meeting, brought forward this admirable suggestion, was not present to second the motion. However, he was sure everyone felt such a deep debt of gratitude to the Directors that the vote could not fail to be carried unanimously and cordially. It was a great pleasure to him to be in any way allied to it; and he hoped the Directors would accept it as some token—a substantial token he might say—of the proprietors' great appreciation of their indefatigable labours, and splendid management in carrying the negotiations mentioned in the resolution to so successful an issue. He remembered seeing at the office of the Association some months ago a chart which struck him as being exceedingly instructive. It represented the rise of capital side by side with the rise of revenue. He noticed that the revenue rose very steadily from the commencement of the Association until the inevitable time arrived when some concession came to an end. Then came a fall. But the reaction was rapid, and the revenue quickly began to go to a much higher level than before the fall; and so the whole career of the Association had continued to mount upwards. Therefore he thought this proved they were in most excellent hands; and the very least the proprietors could offer the Directors was this honorarium of £5000.

The Secretary, replying to Mr. Snowden, stated that the fees of the Board amounted to £5000 a year; and there were ten members. The negotiations referred to had been occupying them many years.

Mr. Snowden remarked that he did not ask the questions with the view of opposing the proposition, but because he thought the fullest possible information should be laid before the proprietors.

The resolution was unanimously carried.

The Chairman, in acknowledgment, said he accepted, on behalf of himself and his colleagues, this very gratifying mark of the confidence of the proprietors. This was a unique vote in the history of the Association—that was to say, there had never been, so far as he knew, any testimonial voted to the Board as a body before. There had been sums voted to individual Directors and to Committees of Directors; but he did not think there had ever been any testimonial to the Directors as a body. He was very glad that the appreciation of the hard work of the Board had not taken the form of an addition to their ordinary fees, as he knew that this would be detrimental to the best interests of the Association. He deeply regretted the absence, through illness, of one colleague—Mr. Bassett—who he was sure would appreciate the compliment paid the Board as much as did any member of it. He concluded by moving a hearty vote of thanks to the officers both at home and abroad.

Mr. J. Horsley Palmer seconded the motion, which was heartily agreed to.

This concluded the proceedings.

SOUTHAMPTON GAS COMPANY.

The Half-Yea rly Meeting of this Company was held at the Offices last Wednesday—Mr. R. C. Hankinson, J.P., in the chair.

The Secretary (Mr. C. Crowther Smith) having read the notice convening the meeting, the report of the Directors was presented. It stated that during the six months ending Dec. 31 last there had been an increase of 9,175,000 cubic feet in the quantity of gas sold, compared with the corresponding period of 1897; and for the entire year it had been 13,986,000 cubic feet. The sum available for distribution was £7888; and the Directors recommended the withdrawal of £466 from the reserve fund. to be added to the above amount, to allow of the payment of the maximum dividends, less income-tax.

The Chairman, in moving the adoption of the report, remarked that there was very little for him to say beyond what was stated in it, as it showed exactly what the Company were doing. Of course, it was never satisfactory to be obliged to take money from the reserve fund to make up the dividends; but the Directors proposed to do this to the extent of £466. It was not much, considering the Company had a reserve fund of nearly £21,000. He might point out that had it not been for the abnormal law charges, amounting to £512, which had been incurred in connection with the poor-rate assessment, there would have been no need to withdraw anything at all from the reserve. The litigation was in consequence of the attempted imposition of additional rates by the Guardians of the Poor. The Company won on all points, and thereby saved £700 a year; and he did not think the shareholders would consider an expenditure of £512 excessive in order to save so large a sum. The Directors were engaged in arranging for the sale of gas by the prepayment system. Already some 127 or 130 meters had been fixed; and the people who consumed the gas in this way were very well satisfied. The plant for the production of carburetted water gas was in a forward state. The consolidation of the share and debenture stock had been completed. There was now only a 5 per cent. ordinary stock and a 4 per cent. debenture stock. The conversion greatly simplified the accounts.

Mr. J. K. Sampson, in seconding the motion, said he might refer to one point not touched upon by the Chairman. The Parliamentary Committee last year ruled that the illuminating power of the gas supplied by the Company should be raised from 14 to 15 candles; but he should like to ask whether anyone among their many customers had detected any difference as a result of this. The accounts, however, showed that the cost of cannel coal had been largely increased as a consequence; and this was one reason why it was so necessary to have carburetted water gas, which would meet the difficulty. This was just an instance where a lot of fuss was made about trifling things of no great consequence; but it had put them to considerable expense.

The Chairman said he omitted to mention the increase in the use of gas cooking and heating stoves. There were now 1380 cooking-stoves at work in the district, besides stoves used for heating purposes.

The motion was unanimously carried; and maximum dividends were afterwards declared.

The retiring Directors and Auditor having been re-elected, a vote of thanks was accorded to the Chairman and his colleagues for their services during the year.

The CHAIRMAN acknowledged the compliment, and proposed a similar vote to the Secretary, Manager (Mr. S. W. Durkin), and staff generally.

This having been unanimously accorded, the proceedings closed.

BRUSSELS MUNICIPAL GAS SUPPLY.

The Gas Committee's Report on the Past Year's Working.

According to the report of the Gas Committee of the Brussels Municipality for the past year, which has lately been presented, the total quantity of gas sold was 29,252,661 cubic metres, or about 1,032,619,000 cubic feet, compared with 28,680,664 cubic metres, or about 1,012,428,000 cubic feet, in 1897; being an increase of 571,997 cubic metres, or 20,191,000 cubic feet. This is not a large increase when compared with that of 1897, when, owing partly to the International Exhibition, the sales went up to the extent of 84 million cubic feet. The total production of gas last year reached 36,542,880 cubic metres (1,289,963,664 cubic feet); and it was disposed of as follows:—

	Cubic Metres.
Night gas, at 14c. and 13c. per cubic metre	23,330,563
Municipal establishments, at 10c.	1,012,107
Gas-engines, at 10c.	1,768,384
Industrial purposes, at 10c.	1,223,612
Heating purposes, at 10c.	763,740
Illuminating devices, balloons, &c.	119,672
Artizans' dwellings and miscellaneous	1,034,583
Total sold	29,252,661
Public lighting and illuminations	4,945,012
Used on the works, &c.	1,160,067
Unaccounted for	1,185,140
Total production	36,542,880

The total receipts amounted to 5,642,647 frs. (£225,706); and the expenses to 3,880,293 frs. (£155,212)—leaving a balance of 1,762,354 frs. (£70,494), compared with 1,687,387 frs. (£67,495) in 1897. Allowing 80,252 frs. for the increased value of the stores, the profit resulting from the undertaking is brought up to 1,842,606 frs. (£73,704).

The section of the report dealing with the manufacturing operations shows that 118,682 tons of coal were carbonized, and 900 tons of oil employed for enrichment. For 1897 the figures were 118,185 and 946 tons respectively. The quantity of coke sold at the works was 706,496 hectolitres (about 1,942,864 bushels); and the whole of the stock was disposed of. Pitch and naphthalene rose considerably in price; but anthracene dropped more than 50 per cent. in value. Heavy oils and those containing creosote were sold regularly, and there were no stocks at the close of the year. The improvement in sulphate of ammonia which was noticeable at the end of 1897 was maintained during the past year; resulting in an increased revenue of about 36,000 frs. As usual, the breeze was utilized in the manufacture of compressed fuel, which is employed in heating the retorts and generators. At the date of the preceding report, the foundations for a new retort-house, forming part of the extensions now being carried out at the works, had been put in. The principal buildings have since been finished, and they will be furnished with the necessary plant in the coming summer, and brought into use before the end of the year, to assist the other works, which have become inadequate.

The total amount of capital employed in the undertaking at the close of 1898 was 23,489,453 frs. (£939,578), compared with 22,308,579 frs. (£892,343) at the corresponding period of 1897. Mains to the extent of 186,882 metres (205,570 yards) occupied the subsoil of the city on Dec. 31, 1898, compared with 179,050 metres (196,955 yards) at the end of 1897. The leakage amounted to 3·24 per cent. of the total quantity of gas sent out. The number of meters in use on the last day of the year was 24,449; being an increase of 1942 in the twelve months. There were 290 prepayment meters fitted up; making a total of 1721 meters of this kind in use in the city. There was a slight falling off in interior fitting work last year; the number of orders received being 947, against 1207 before. At the close of the year, there were in use 6203 of these inside installations, as well as 3037 rising pipes. The gas-stoves on hire numbered 14,729, against 13,038; and 346 gas-engines, representing 2736-horse power, were at work—the larger number of them being in printing, lithographing, and bookbinding establishments. Outside lanterns are let to private consumers; and 27 single-jet and 152 high-power lamps were in use at the close of the year. For the public lighting, there were employed 6198 lamps, of which 682 were fitted with high-power burners. The total number of hours of lighting was 3826. Between midnight and one o'clock in the morning, 654 high-power and 1090 of the ordinary burners were turned off during the year.

MAIN-LAYING TROUBLES AT ORMSKIRK.

Some unpleasantness has arisen at Ormskirk, between the District Council and the Gas Company, on the question of the location of the mains of the latter. It appears that Mr. Martin, the Company's Manager, gave notice to the Surveyor that he was about to open a road to lay a gas-main along the footpath, and on this being reported to the Council, the Chairman (Mr. R. Walker) said it was thought desirable that something should be done to prevent mains being placed in the position indicated. The Clerk was referred to on the subject; and he pointed out that the liability to repair any damage caused was entirely cast upon the Company. A plan had been submitted, but was not approved; and he supposed the work might be done at the Company's own risk.

We understand that prior to the Council meeting the attention of the Clerk had been called to the report of the proceedings in the arbitration between the parish of St. Pancras and The Gaslight and Coke Company on the question of dispensing with consent for the location of mains, as given in the "JOURNAL" for the 14th of March last; and his reply seemed to cause some astonishment in the Council. Mr. Draper said he had awaited the decision; but if the Council were powerless on this score, they need not be in another direction. He moved that it be an instruction to the Surveyor to require strict compliance with the Act of Parliament so far as regarded the Company interfering with the roads of the town in the future. This, he thought, would give them the best lever it was possible to have. As an Authority, the Council had tried to work on amicable terms with the Company, but had failed through the actions of the Manager. Mr. Wilson seconded the motion. Mr. Jones said he supposed the Clerk's decision would not apply to the owners of property who might still object to the laying of mains under the footpath. The Clerk said that was so. The motion was carried.

Subsequently some correspondence was read from the Secretary and the Manager of the Company with reference to laying mains in a new street under construction. The Company had taken up some 5-inch mains for the purpose of substituting others of larger diameter; and they purposed using them for the new street, about 400 yards distant. The Council objected to this—contending that no gas-pipes which had been taken up should be relaid; and they passed a resolution instructing the Clerk to write to the Secretary, stating that if the Company put the old pipes in the new street they would not take it over when completed. The Council do not appear to have had much reason for their objection, inasmuch as the Company furnished satisfactory proofs of the soundness of the pipes, in the shape of a certificate from four ironmasters to the effect that they were in a perfectly fit condition for further service. Their course of proceeding, therefore, looks like obstinacy. Hitherto they have not been able to enforce their contention; but in the present case they appear to think they can do so, as the owner of the land has paid a premium upon it, and the approval of the Council for the construction of the street is necessary before they will take it over. This is a case in which the relations between the Company and the Council might certainly be improved.

SOUTHPORT GAS AND ELECTRICITY FINANCES.

The Finance Committee of the Southport Corporation had before them yesterday week the annual report on the financial position of the borough. It shows that the gas undertaking had a good year. The net profits amounted to £15,147; and after handing over £7000 to the relief of the rates, and wiping off £4536 deficit from the previous year, there remained £3610 to be disposed of. This balance it is proposed to dispose of as follows: Writing off £970 on gas-cooker account, and transferring £500 to workmen's compensation fund account, £1000 to reserve fund, and the remainder, £1139, to a renewal fund. The gross profits for the year were £23,978—the highest yet made—and the net profit has only once been exceeded (in 1895), when the price of gas was raised in consequence of the coal strike. For the coming year, the amount to be handed over in relief of the rates is to be raised to £8000. The profits of the Electricity Committee have amounted to £2000, of which £620 goes to the relief of the rates, and £203 to the balance of the £678 disallowed by the Local Government Board. The balance is at the disposal of the Committee for writing off various items placed to capital account which have become obsolete, and been replaced by others of an improved type. The sum of £15,000 has been added to the indebtedness during the year on account of gas-works and electric lighting, increasing the charge for the sinking fund to the extent of £469.

THE BOLTON CORPORATION TAR TENDERS.

Explanation by the Chairman of the Gas Committee.

At the Monthly Meeting of the Bolton Town Council last Wednesday, the reconsidered decision of the Gas Committee in regard to the tar tenders for the ensuing twelve months was brought forward for confirmation in the minutes. Mr. T. E. Flitcroft said the Council would be glad to hear some explanation from the Chairman of the Gas Committee in regard to the tar contracts, because there was a feeling abroad that something had been done which was not quite open. Alderman Miles, in response, said it would be remembered that at the previous meeting (*ante*, p. 928) he asked that the proceedings in connection with these tenders should be referred back. He gave two reasons why this course should be adopted. One was that nearly all the statements made were misleading and inaccurate; and the second was that some arrangement could be made with regard to the tar tenders which would be satisfactory to all parties. Reviewing what had occurred, he said that in the first place the Committee advertised for tenders, and deliberately decided, before they were opened, that the highest should be accepted—subject, of course, to the parties submitting it being satisfactory people. It was also agreed that if it were a case of two tenders being alike, preference should be given to the local firm. When the tenders were opened, it was found that the local firm offered 27s. 6d. per ton, with a postscript to their tender to the effect that they would be prepared to give 6d. per ton more than anyone else. He had been told by several members of the Council that if this tender had been sent to them in their way of business they would have put it behind the fire; but the Committee did not adopt this course, having such a kindly feeling towards local industries that they did not wish to handicap them in any way. The outside tender was 27s. 7d.; and the Committee suggested that the contract should be divided. A great deal had been said about the outside firm's representative being called into the room and asked whether he was willing to divide his tender. In fact, the question had been asked why he was there at all. He (Alderman Miles) would answer that question by asking another: Why was the representative of the local firm present? He would go further, and ask why these two representatives had been there on these occasions for the last four years, which had been the case to his certain knowledge. The representative of the outside firm was asked to come into the room; and it was suggested that the tender should be divided. The representative said: "Well, we tendered for the lot; and I think if I am the highest tenderer I am entitled to the lot." Thereupon the Gas Committee, as honourable men, decided that, as Messrs. Turner's

offer was the highest received, it should be accepted for the whole of the tar. A member of the Council who was not present that morning felt aggrieved; the reason being that he had been interviewed by the local firm, and had had a great deal of misrepresentation poured into his ears, as was the case with other members. At the next meeting of the Committee, this gentleman, carrying the members with him, got the previous resolution rescinded. When it came before the Council, it was referred back; for the Committee had divided the contract between the local firm (who had 2200 tons) and Messrs. Turner and Co. It had been alleged that the Committee would, in the case of the outside firm, have to pay for the bondage of the tar, which would mean from 1½d. to 3d. per ton more; but, as a matter of fact, it worked out at exactly ½d. per ton. Even with this ½d. taken away from the 1d. per ton difference in the contract, they got more from the outside firm this year. In conclusion, Alderman Miles said that in their dealings with regard to the contracts the Gas Committee had only one object in view—viz., that of making their department as great a success as possible; and the principle they set before themselves was to buy in the cheapest and sell in the dearest market. He thought their success in the past showed that the undertaking had been well managed, and that the Committee were entitled to the confidence of the Council. The minutes were confirmed in their entirety.

DUKINFIELD GAS DEPARTMENT.

The Past Year's Working.

The Gas Engineer and Secretary to the Urban District Council of Dukinfield (Mr. Harrison Veevers) has presented his report for the year ending the 25th of March. It opens with the satisfactory statement that the improved financial position of the undertaking recorded in the previous report has been continued. The profit to be added to the reserve or suspense fund—£1074 15s. 1d.—is double that of last year, and has enlarged the fund to a total of £1297. In the face of a probable increase in the price of coal during the current year, and of expenditure on replacements of plant and apparatus originally charged to capital, Mr. Veevers thinks it will not be advisable to reduce the price of gas at present. The demand for prepayment meters shows no diminution. The increased number fixed during the financial year was 52; making the total number in use 602. The quantity of gas registered by them was 4,567,000 cubic feet, equal to nearly 6½ per cent. of the total sale, and increasing the gross income for gas by £704. With regard to the works, Mr. Veevers says the probable requirement of greater gas-holding capacity, or a substitute by some plan of producing gas quickly, will have to be considered in the not distant future. Every inducement has been given for the greater consumption of gas by the provision by the Committee of meters and of pipes for cookers and stoves free of charge; and, in consequence, there will be an improved income in immediate future years. The accounts accompanying the report show that the gas-rental in the past financial year amounted to £9778, compared with £9322 in the year 1897-8; the revenue being £11,629, against £11,068. The expenditure was £7641, compared with £7410; the balance being £4051, against £3658. The quantity of gas made was 78,514,000 cubic feet, of which 71,040,900 cubic feet were sold and used on the works; showing a loss of 7,473,100 cubic feet, or at the rate of 9·51 per cent.—an improvement upon the year 1897-8, when, owing to fractures in the pipes caused by sewerage operations, it was 10·13 per cent. The net cost of production, exclusive of capital charges, works out to 1s. 7·35d. per 1000 cubic feet of gas sold; but with these added it is brought up to 2s. 5·4d. As the average price of gas is 2s. 9·03d., the profit is 3·63d., compared with 1·83d. for the year 1897-8. A table giving the various items of the balance-sheets from 1889 shows that the income in that year was £6953, with the price of gas at 2s. per 1000 cubic feet; whereas in the year just closed it was, as mentioned above, £9778, with a charge of 2s. 11d.

LINCOLN CORPORATION GAS UNDERTAKING.

Results of the Past Year's Working—Projected Extensions at the Works.

At the Meeting of the Lincoln City Council last Tuesday, the Chairman of the Gas Committee (Mr. T. Wallis) made his customary statement as to the working of the undertaking during the past financial year.

Mr. Wallis first compared the general results of the years ending March 25, 1898 and 1899. He said that in 1898 the expenditure was £24,437, and for 1899 £27,483—an increase of £3046. The income for 1898 was £36,791, and for 1899 £37,934; so that there was an increase under this head of £1143. The gross profits in 1898 were £12,353, and in 1899 £10,541; and this they had to deal with. The working, he was glad to record, had not been worse than in the previous year, in spite of the electric light. The profit had been somewhat less, owing to several items of extraordinary expenditure, which had been paid out of revenue, and to the reduction in the price of gas, which made a difference of £1300. There had been two extra items of expenditure amounting to £450 and £600, the former of which would not occur again. The price of coal had also been dearer. The contract for 1899 was 6d. a ton more, which made £700 difference. These various sums totalled to £3050. The surplus profit of £2252 was arrived at in the usual way, after the deduction of the annual fixed charges; and that was the amount they had to deal with. The Committee thought the best thing to be done would be to offer £1200 to the general district rate account; and this would leave something like £1000 to be carried forward. During the year they had carbonized 27,924 tons of coal, as against 25,950 tons in 1898. The amount of gas made in 1898 was 269,682,000 cubic feet, as against 285,095,000 feet in 1899—an increase of 15,500,000 feet. The number of consumers had advanced from 7335 to 7689, or by 254. Since the undertaking started, the consumers had had a fair share of the profits. At the commencement, the price of gas was 2s. 8d., and now it was only 2s. 1d. per 1000 cubic feet, which meant a difference of £7000 a year. He felt they had fallen upon evil times, however, and what Mr. Page said last year was only too likely to come true. They were approaching the time when probably the demands of the city would require something in the nature of capital expenditure; and he was afraid the consumers must not look for anything further in the way of reduction during the coming year. They had already passed resolutions, and even ordered pipes, &c., costing £3000. They were really necessary on account of the present pipes being now too small. Some of the new ones were 24 inches in diameter. Another large expenditure during the year was likely to accrue owing to the increased cost of coal. Although the price was only 6d. per ton more last year, he thought in the coming one it was likely to be advanced by 1s. 6d. a ton. This meant something over £2000 a year to them. So if they added £2000 to the £3000 which they had already committed themselves to expend, they had £5000 which they would have to spend. To this they must add the cost of water-gas plant, which it was also intended to put down, at a cost of about £9000 or £10,000. He thought this would be a very wise step, as they would save in coal alone to March 25 next £500. The total expenditure required was £15,000; and if the Local Government Board would not consent to a loan for water gas, they might perhaps pay for it out of revenue. He acknowledged the great help he had received from the Gas Manager (Mr. John Carter), and the great amount of work which he had accomplished for the good of the undertaking during the year.

Mr. Goy thought it was very creditable indeed to those who sat in that chamber in years gone by that the undertaking had been worked in the manner it had been to bring in such a revenue. There were many other things in the city which might be worked at a profit if the Council would only say the word and purchase them.

Mr. Footman hoped the Gas Committee had not committed themselves to water gas.

The Mayor (Alderman Wyatt) said that, as a gas consumer and a ratepayer, he would like to express his acknowledgments to the Gas Committee and to Mr. Carter for the excellent way in which the undertaking had been managed during the year.

Mr. Wallis expressed his opinion that the dangers of water gas were exaggerated, and stated that it was only proposed to use it in the daytime.

The minutes were passed.

ROTHERHAM CORPORATION GAS UNDERTAKING.

Annual Statement.

At the Meeting of the Rotherham Town Council last Wednesday, Mr. Gummer, the Chairman of the Gas Committee, made his annual statement on the work of the department.

Mr. Gummer said he thought the Council would feel pleased that the profits on the year's working had increased, more particularly seeing that the expenses and the disturbance and alterations at the works had almost led to the belief that they would come out with a slight loss. If it had not been for the greatly increased consumption brought about to a large extent by the popularity of the penny-in-the-slot meters, that would probably have been the case. The make of gas had been 18,220,000 cubic feet greater, or nearly 20·5 per cent. more than the previous year. The consumption had not increased in the same proportion, accountable to a great extent by extra leakage through disconnecting mains, and alterations of the works. Still the consumption had increased by 14,387,400 feet, or 7½ per cent. With regard to the prepayment meters, the additional consumption had been 26 per cent., and the gain in the gas consumed by the ordinary meters had only been 4½ per cent. In the borough they had 11,704 houses and only 9311 meters. At present there were, therefore, 2393 houses not supplied with gas. Possibly the reason was that a number of people had an idea that the price of gas was higher than it ought to be. Year by year the department was expected not only to illuminate the streets at a very heavy cost, but to make up the deficits of other departments. The gas consumer had probably some justification in saying he had to pay double in rates by the extra price of gas. They had at present 5146 prepayment meters in use. During the year they had fixed 728 of these meters; and members of the Council had asked if they were justified in continuing to put in these meters and allowing the addition to capital with the idea of extending the consumption. He thought justification had come from the fact that, in spite of the number of automatic meters, the increase continued. It had been freely said that the profits were not what they ought to be. He had given some explanation; and he further pointed out that during the year they had had to pay 4d. per ton more for coal, which had swallowed up a considerable sum. They had also paid in wages an increased amount of £487—in carbonizing, purifying, and other matters, all of which came under the head of wages (£2540), and in salaries £110. While the make of gas had increased, the expenses had also risen. The increased cost of public lighting had been £496. As to this particular item, he mentioned that three years ago, at his suggestion, the lighting was handed over to the Gas Department, and by curtailing the lights on moonlight nights, especially in the outer districts, the saving in one year alone was £700. They were now falling back to the old method, with the result that the increased cost of public lighting this year was £496 over the previous one. He hoped the Committee would take some steps in this direction, if they could do so without disadvantage to the public. Having explained that the clearing out of an old stock of meters had caused depreciation to the extent of £203, he remarked that, if the price of coal was not increased, it was likely the gas-works would, in the near future, yield a handsome profit to the Corporation. It was stated that the profit for the past year was £1397. It was only fair to the department to explain that the net profit, so far as the working was concerned, was £3337, because the only matters really chargeable to be taken out of the gross profits were the redemption instalments, dividends on stock premiums on stock purchased, and interest on mortgages. These totalled to £6491, leaving the net profit of the department £3337. Before these figures were arrived at, the cost of public lighting was deducted, which should no more be taken out than the deficits on the markets and water-works. If the department had to make up these deficits, they would practically have had no profit at all. Taking everything into consideration, he thought they had nothing to complain about in regard to the working of the department; and he was of opinion that in the near future the works would be a source of revenue, and they would be able by the improvements and better methods of producing gas, and the increased number of consumers, to do better in every way.

Mr. JENKINSON seconded the motion, and, alluding to a suggestion that the price of gas to consumers should be reduced, said he was afraid there was very little hope of this, or of a profit of £1400 being realized in the present year. Instead of having to pay 4d. per ton more for coal, it was probable they would have to pay 1s. 4d.

Mr. WINTER thought, on the whole, the results had been satisfactory. There had been special expenditure dealt with out of revenue, which reduced the net profit. With regard to the public lighting, the cost was added to the revenue, but afterwards deducted for the purpose of ascertaining the profits. They had an increasing borough, and many more streets than in 1895-6 and 1894-5; and it was only reasonable to suppose that the cost of public lighting would be more. In 1895-6 the cost was £2162, and in 1894-5 £2022, whereas last year it was £1940. He thought some explanation was due on the subject.

Mr. GUMMER said he had already explained the reasons for the diminution. He added also that a more economical means of illumination had been adopted by the introduction of incandescent lights. They had, however, substituted the burners which had consumed 5 feet for others consuming 6 feet of gas per hour. He thought a saving might be effected notwithstanding the changes.

The report was then passed.

ELECTRIC LIGHTING NOTES.

The Crewe Town Council were informed by the Chairman of the Electric Lighting Committee last Wednesday that the Local Government Board had granted the application of the Council for a loan of £26,000 for electric lighting. The loan for the works had been sanctioned for 25 years; and that for the purchase of land for 50 years.

A communication has been received by the Leamington Town Council from the Board of Trade, intimating that they are prepared, under certain conditions, to grant them a Provisional Order for the lighting of the borough. The conditions have, it is understood, reference to the rights of the Midland Electric Lighting Company, who for many years have been supplying light in the borough under an agreement with the Corporation.

Subject to the approval of the ratepayers, the Heckmondwike District Council have adopted a report by their Consulting Electrical Engineer (Mr. Hawtayne) on a scheme of electric lighting. It provides for a plant which will light the whole of the public lamps in the township with electricity instead of gas; and it is stated that there is an encouraging list of prospective private consumers. The estimated cost of the entire scheme is £13,000; and the output is calculated to realize the annual amount necessary to pay the interest and provide for the sinking fund, together with a net profit of £230 for the reduction of the rates.

The subject of the electrical supply at Wigan has reached a stage when it must be seriously considered both by the Town Council and the ratepayers. These were the words of Alderman Holmes at the meeting of the Corporation, when informing his colleagues that the Committee were proposing to ask the Local Government Board for sanction to the borrowing of £90,000 for the purposes of the department. Mr. M'Quaid pointed out that the first estimate the Committee placed before the Council was for £20,000; and naturally he was anxious for an explanation as to why the amount had increased so enormously. Alderman Holmes's reply was that they had to take into account the equipment of the tramways, as there was a proposal to municipalize them.

The electricity supply station of the South Australian Electric Light and Motive Power at Port Adelaide was opened on the 2nd of January; so possibly the plant is not yet in thorough working order, as there have been a good many complaints. According to a report, in the "South Australian Register" for the 1st ult., of what took place at the meeting of the Port Adelaide Municipal Council on the previous Thursday, the Councillors are growing impatient, as two of them asked when the Electric Light Committee would be called together; one saying it was high time a meeting was called to consider the very unsatisfactory state of the street lighting. The Mayor (Mr. T. Grose) replied that the ratepayers had not had much to complain of up to the present. As they were not paying anything for it, he thought they might forbear a little. The other Councillor pointed out that they were, inasmuch as they were paying the lighting-rate.

Alderman J. Brodie submitted to the Blackpool Town Council last Tuesday the statistics of the Electrical Department for the year ending March 31 last. The income was £15,508, and the expenditure £8044; leaving a gross profit of £7464. Deducting interest and sinking fund, amounting to £5324, there was an available balance of £2140. It had, he said, been argued that now that the electricity works were being made to pay, a reduction of the price for the light should be made. He reminded the members, however, that some three years ago fifty miles of the cables went wrong and became absolutely useless. A suspense account was therefore created to the extent of £12,000 which had to be paid off; and until this was done, there could be no general reduction in the price of electricity. The electric energy for the tramway was supplied by the Electricity Department; and a charge of 2d. per unit was made. The total cost of traction was £1500 for the year; being a shade under 1½d. per mile. But now that the overhead system was being substituted, it was hoped that the cost would be reduced to under 1d. a mile.

Shortly before ten o'clock on the night of Saturday, the 29th ult., something went wrong with the municipal electricity supply undertaking at Wolverhampton, and in an instant the town was in darkness. Fortunately many who had adopted the electric light in their shops and business establishments had not dispensed with the gas supply, and consequently they suffered the least inconvenience. Others, however, had placed implicit confidence in the efficiency of the newer illuminant; and when this failed, operations had to be suspended until lamps and candles could be brought into requisition. The situation, although serious in some respects, was not without its comic side. In the Grand Theatre and the Empire Palace of Varieties there was darkness till the gas was turned on; and the window of a shop kept by a member of the Town Council was illuminated by two candles fixed in aërated water bottles. The Market Hall, which is lighted entirely by electricity, was packed with people, and there was considerable confusion. The cause of the trouble, according to the Electrical Engineer (Mr. Shawfield), was the failure of the insulation of two armatures belonging to the 140-kilowatt generators; the result being to completely disable machinery to the extent of 500-horse power, and to cause a temporary extinction of the lights. Other generators were at once re-started, and the

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 1208.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	Apl. 13	10½	Alliance & Dublin 10 p. c.	21½—22½	..	4 13 4
100,000	10	"	7½	Do. 7 p. c.	15½—16½	..	4 10 11
300,000	100	Jan. 3	5	Australian 5 p. c. Deb.	104—106	..	4 14 4
200,000	5	Nov. 11	6	Bombay, Ltd.	6½—7½	..	4 2 9
40,000	5	"	6	Do. New, £4 paid	4½—5½	..	4 11 5
880,000	Stk.	Feb. 24	12	Brentford Consolidated	275—280	..	4 5 9
240,000	"	"	9	Do. New	215—220	+2	4 1 10
50,000	"	"	5	Do. 5 p. c. Pref.	140—145	..	3 9 0
159,375	"	Dec. 15	4	Do. 4 p. c. Deb.	128—133	..	3 0 2
220,000	Stk.	Mar. 29	11½	Brighton & Hove Orig.	265—270	..	4 5 2
236,320	"	"	8½	Do. A. Ord. Stk.	194—197	..	4 6 4
973,500	Stk.	Feb. 24	5	Bristol, 5 p. c. max.	125—130	..	3 16 11
420,000	20	Mar. 29	10	British	47—49	..	4 1 8
50,000	10	Feb. 24	12	Bromley, Ord. 10 p. c.	25—27	..	4 8 11
75,000	10	"	9	Do. 7 p. c.	20—22	..	4 1 10
500,000	10	Apl. 27	6	Buenos Ayres (New) Ltd.	10¾—11¼	..	5 6 8
220,000	Stk.	Dec. 30	4	Do. 4 p. c. Deb.	103—105	..	3 16 2
150,000	20	Mar. 10	8½	Cagliari, Ltd.	28—29	..	5 13 10
100,000	10	Sept. 29	7	Cape Town & Dis., Ltd.	13½—14½	−½	4 16 7
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	56—58	..	5 3 5
550,000	Stk.	Apl. 13	13½	Commercial Old Stock	310—315	..	4 5 9
200,750	"	"	10½	Do. New do.	245—250	+5	4 4 0
200,750	"	Dec. 15	4½	Do. 4½ p. c. Deb.	145—150	..	3 0 0
800,000	Stk.	Dec. 15	10	Continental Union, Ltd.	207—212	+4	4 14 4
200,000	"	"	7	Do. 7 p. c. Pref.	187—192	..	3 13 11
51,600	Stk.	Feb. 24	14	Croydon A 10 p. c.	305—310	..	4 10 4
168,400	"	"	11	Do. B 7 p. c.	255—265	..	4 3 0
555,000	Stk.	Feb. 24	5½	Crystal Palace Ord. 5 p. c.	130—135	..	3 17 9
60,000	"	"	5	Do. 5 p. c. Pref.	140—145	..	3 9 0
486,090	10	Jan. 27	11	European, Ltd.	23—24	..	4 11 8
354,060	10	"	11	Do. £7 10s. paid	17—18	..	4 11 9
14,993,075	Stk.	Feb. 10	4⅛	Gas-light and Coke	4 p. c. Ord.	114—116	−1	4 4 6
					3½ p. c. max.	101—103	..	3 6 0
					4 p. c. Con. Pref.	128—130	..	3 1 7
					3 p. c. Con. Deb.	101—103	..	—
2,400,000	"	"	3½					
3,799,735	"	"	4					
3 843,975	"	—	—					
70,000	10	Nov. 11	8	Hongkong & China, Ltd.	14—15	..	5 6 8
3,800,000	Stk.	"	10	Imperial Continental	227—232	+2	4 6 2
376,400	100	Feb. 1	4	Do. 4 p. c. Deb. Red.	98—101	..	3 19 3
473,600	Stk.	Feb. 10	3½	Do. 3½ p. c. Deb.	102—105	..	3 6 8
75,000	5	Nov. 30	6	Malta & Medn., Ltd.	5—5½	..	5 9 1
560,000	100	Apl. 4	5	Met. of 5 p. c. Deb.	111—113	..	4 8 6
250,000	100	"	4½	Melbourne 4½ p. c. Deb.	110—112	..	4 0 4
541,920	20	Nov. 11	5	Monte Video, Ltd.	15½—16½	..	6 1 3
617,946	Stk.	Feb. 24	9½	Newc'tle & Gatesh'd Con.	228—233	..	3 19 5
264,855	Stk.	Dec. 30	3½	Do. 3½ p. c. Deb.	107—110	..	3 3 8

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
150,000	5	Nov. 30	8	Oriental, Ltd.	7½—7¾	..	5 3 3
135,000	5	"	8	Do. New, £4 10s. pd.	6½—6¾	..	5 6 3
15,000	5	"	8	Do. do. 1879, £1 pd.	1½—1¾	..	4 11 5
60,000	5	Mar. 29	7	Ottoman, Ltd.	4¾—5¼	..	6 13 4
500,000	100	Dec. 1	6	People's Gas of Chicago 2nd Mtg. Bonds	102—106	..	5 13 2
848,070	10	Apl. 27	7	River Plate Ord.	11½—12	..	5 16 8
250,000	Stk.	Dec. 30	4	Do. 4 p. c. Deb.	103—105	..	3 16 2
250,000	10	Mar. 29	10	San Paulo, Ltd.	16½—17½	+½	5 14 3
135,000	Stk.	Mar. 29	10	Sheffield A.	237—240	..	4 3 4
209,068	"	"	10	Do. B.	237—240	..	4 3 4
447,427	"	"	10	Do. C.	237—240	..	4 3 4
5,600,000	Stk.	Feb. 10	5⅓	South Metrop., 4 p.c. Ord.	139—142	−1	3 15 1
1,460,000	"	Jan. 13	3	Do. 3 p. c. Deb.	101—103	..	2 18 3
—	—	—	—	Tottenham and Edmonton A.	—	—	—
—	—	—	—	B.	—	—	—
182,380	10	Dec. 30	5	Tuscan, Ltd.	9—10	..	5 0 0
149,900	10	Jan. 3	5	Do. 5 p. c. Deb. Red.	99—101	..	4 19 0
				WATER COMPANIES.			
¶46,184	Stk.	Dec. 30	11	Chelsea, Ord.	318—323	..	3 8 1
150,000	"	"	5	Do. 5 p. c. Pref.	168—173	..	2 17 10
160,000	"	"	4½	Do. 4½ p. c. Pref. ¶5	150—155	..	2 18 1
175,785	"	Mar. 29	4½	Do. 4½ p. c. Deb.	155—160	..	2 16 3
1,720,560	Stk.	Apl. 13	7	East London, Ord.	218—222	..	3 3 0
654,740	"	Dec. 30	4½	Do. 4½ p. c. Deb.	156—159	..	2 16 7
390,000	"	"	3	Do. 3 p. c. Deb.	102—104	..	2 17 8
700,000	50	Dec. 15	7½	Grand Junction 10 p. c. max.	113—116	+1	3 4 7
310,000	Stk.	Mar. 29	4	4 p. c. Deb.	135—140	..	2 17 2
708,000	Stk.	Feb. 10	14	Kent	355—360	..	3 17 9
160,000	"	"	7	Do. New, 7 p. c. max.	210—215	..	3 5 1
1,043,800	100	Dec. 30	10½	Lambeth, 10 p. c. max.	300—305	..	3 8 10
406,200	100	"	8	Do. 7½ p. c. max.	230—235	..	3 8 1
350,000	Stk.	Mar. 29	4	Do. 4 p. c. Deb.	135—140	..	2 17 2
500,000	100	Feb. 11	13½	New River, New Shares	433—438	..	3 2 9
1,000,000	Stk.	Jan. 27	4	Do. 4 p. c. Deb.	137—142	..	2 16 8
902,300	Stk.	June 29	7½	South-wark and 5 p. c. Pref.	215—220	+5	3 8 2
126,500	100	"	7½				
489,200	Stk.	"	5				
1,019,585	"	Apl. 13	4	Vauxhall 4 p. c. A Deb.	195—200	..	3 15 0
1,155,066	Stk.	Dec. 15	10	West Middlesex	168—171	..	2 18 6
200,000	"	"	4½	Do. 4½ p. c. Deb.	135—140	..	2 17 2
200,000	"	Mar. 10	3	Do. 3 p. c. Deb.	302—307	..	3 5 2
					159—162	..	2 15 7
					102—104	..	2 17 8

* Ex div.

light was turned on again; the total period of extinction being twenty minutes. Further inconvenience was occasioned on the following Monday evening by another failure of the light. The mishap occurred before the street lamps had been turned on; but at the theatres, and at the Free Library technical classes, the evening's proceedings had just commenced, and great annoyance and difficulty was experienced. The first cessation was of eleven minutes' duration; and at the expiration of that time the supply was restored for a few minutes. It, however, failed again, and was in the second instance off for a quarter-of-an-hour. Mr. Shawfield's explanation of the failure is that it was partly due to the same cause as that of the previous Saturday. It was true there was no breakdown of the machinery on this occasion; but a fault occurred in the system, which caused all the machines to cut themselves out of circuit.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The financial year of the Hamilton Corporation gas undertaking has been closed; and it is reported that a profit of £1856 has been made. The Gas Committee recommended that a sum of £1200 be written off for depreciation, and that the balance of £656 be carried forward. At a meeting of the Corporation on Thursday, however, Treasurer Keith moved that £500 of the balance be set apart in a special account which is to be known as the Common Good Account. His argument was that the gas undertaking should be carried on, not for the benefit of gas consumers, but for that of the whole community. He adroitly concealed what the purpose is which he has in view; and his party, when the question was hinted at, raised the objection that the application of the money was not before the Council. One gentleman wailed that they had not a penny to fall back upon—not even £5 to give to a band. After this who would care to live in Hamilton? Unless, to be sure, this lamentable state of matters should chance to be removed, and a new era of Municipal happiness and prosperity be introduced by the plundering of the coffers of the Gas Treasurer. For the Council, by eight votes to five, resolved to do what Treasurer Keith urged them to do. His appropriation of gas funds is, of course, a retrograde step on the part of the Town Council. It is bad enough when money is so taken for a specific object; but it is far more reprehensible when, as in this instance, the money is put aside for any undisclosed purpose whatever. It is now at the mercy of any catch vote in the Council; and they may spend it in the most extravagant manner. There is no check upon them, unless it were possible to declare the whole affair illegal. This, of course, depends upon the provisions of the Hamilton Gas Acts, with which I am not familiar. If the money is to be expended upon brass bands, the case will not be so strong as was the Edinburgh one last year, in which, by order of the Sheriff, contributions to hospitals had to be refunded. The matter is worth looking into.

The Council then proceeded to consider a petition by workmen regarding the method of paying them their wages. It would seem that of late a scheme has been adopted, under which the men sign pay-sheets. Those who are on the night shift, and who formerly sent a messenger for their pay, have now to get out of bed, repair to the works, and await the pleasure of the Town Chamberlain's clerk. This is the grievance. It is not a big one; but it afforded Mr. Tainsh an opportunity of saying some nasty things about the Manager (Mr. W. Ewing). So far as I can gather, Mr. Tainsh is of opinion that men have been employed and paid for working when they were not doing anything. The matter is a serious one; and I see that Mr. Ewing so regards it, for he has written a letter upon it to a local newspaper which is couched in a tone of defiance. The subject was sent to the Gas Committee for further consideration.

The erection of the proposed sulphate of ammonia works was the subject of another petition to the Town Council. The proprietors and occupiers of property near the gas-works have been told by the opponents of the proposal that a nuisance will be created; and they have petitioned the Council not to proceed with the work. A firm of law agents have also written a warning, to the effect that they reserve "their clients' right to take whatever action they may deem necessary to prevent the nuisance and annoyance which would inevitably follow the erection of the ammonia works." Bailie M'Hale, the Convener of the Gas Committee, made a statement in which he explained that the Council had power to erect the works wherever they liked, and as near to dwelling-houses as they cared; but he assured the petitioners that there would be no nuisance, and that they would never know that the works were there. They had, he said, procured a sample of spent liquor from the Rothesay Gas-Works, to show that no nuisance would be created by running the liquor into the town's sewers. The complaints were also remitted to the Gas Committee; but, at the same time, arrangements are being made for proceeding with the erection of the works.

The Corporation of Dundee have this week had their Bill for the extension of the gas-works and tramways passed by a Committee of the House of Lords. A portion of the Bill, in which powers were asked for the extension of the city boundary, was ignominiously rejected, with the unusual infliction upon the promoters of the expenses of the opponents of the proposed extension. These opponents were the Police Commissioners of Broughty Ferry and the owners of the lands which it was proposed to annex. The failure of this part of the Bill is generally set down to a too masterful attitude on the part of the Dundee Corporation. The gas clauses were, however, approved of; and the extension of the gas-works will surely now be proceeded with.

A Forfar newspaper this week publishes the report by Mr. A. Smith, of Aberdeen, upon the plans for the new gasholder which have been prepared by Mr. Forbes Waddell; and then the Editor proceeds to find, in the report, material for condemning Mr. Waddell in the most out-and-out fashion. I do not regard this with much concern, for a Gas Manager is usually regarded by anonymous and irresponsible newspaper men as an excellent target. But Mr. Smith's report is a somewhat heavy document. He makes quite a number of recommendations—such as that the guide-framing and the sheeting need not be so heavy as shown; that the contractor should be bound to keep the works free of water while under construction; and that it should not be necessary to excavate

the whole of the material in the tank. I do not know whether the recommendations will be adopted or not. They are mostly upon matters about which there is room for difference of opinion; and it probably would have been better, when it was resolved to call in Mr. Smith, that he should have been asked to furnish the plans. By following the other method, the Corporation have opened the flood-gates of abuse, which I have little doubt will, at their next meeting, be poured without stint over the head of Mr. Waddell.

It is intimated that the Directors of the Bridge of Allan Gas Company contemplate the transfer of their works to a new site, which they have succeeded in purchasing. This site is a brickfield, and is not quite so prominent in the landscape as the present one, which will be an advantage to such a place as Bridge of Allan. The present works catch the eye of every visitor approaching the town from the south. In this conspicuous position they would be, and probably are, an eyesore to many; but cause of offence to æsthetic nature is, as far as possible, removed by painting the gasholders a slate colour, instead of the customary glaring tints. The effect is very pleasing.

I have had put before me a statement regarding the undertaking of the Galston Gas Company. Galston is a small town in Ayrshire. The Manager during the past seven years has been Mr. Robert Muir. He has reduced the price of gas from 5s. to 3s. 9d. per 1000 cubic feet, rebuilt the retort-bench on regenerative principles, and about doubled the purifying plant. Leakage of gas has been reduced from 31 per cent. to about 10 per cent., one effect of which is that, while the make of gas has increased by about 2 million cubic feet, the sales have increased by about 2¾ million feet. Such ability is always worthy of recognition; and I give this short statement with the utmost pleasure.

A gratifying incident is reported to me from Glasgow. At present a large gas-main is being laid in the Great Western Road by Mr. W. Pollock, of Glasgow. It is a work which very few people like to have going on in their neighbourhood—being usually attended by a great deal of discomfort to the inhabitants. Mr. Pollock's men, however, gave so little annoyance in getting along that the heart of Mr. John Anderson, of the Polytechnic—a gentleman well known in Glasgow for his urbanity of manner and his benevolence—was moved; and the other day he treated all the workmen to dinner. Such attentions as these help to bridge over in the happiest manner the gulf which separates class from class.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *May* 6.

Sulphate of Ammonia.—There has again been a strong market, and prices have advanced at all points, Scotland leading the way. The closing quotations were £11 7s. 6d. to £11 10s. per ton f.o.b. English ports; but even higher prices are reported from Scotland. The most urgent demand has been for immediate delivery; and extreme prices have been paid in this position. But there has also been large buying for the early Summer months at a moderate discount on prompt values. The demand has been partly for "covering;" but consumers, having now realized the actual situation, have bought freely, and there are still large requirements to fill. Home consumption is a diminishing quantity; but it is by no means yet over. In the forward position, £11 to £11 2s. 6d. per ton has been paid for November-April delivery, f.o.b. Leith, indicating confidence in the permanence of the advance. For the early Autumn months, makers have also advanced their quotations; but so far buyers have not responded extensively.

Nitrate of Soda is a shade firmer on spot; 8s. per cwt. being the quotation for fine quality.

LONDON, *May* 6.

Tar Products.—Pitch and creosote still remain the firmer of these, although it is scarcely expected in the case of creosote that much further improvement can take place. With pitch, some additional advance is possible, with the higher prices of coal; but the continuance of the coal strike in Belgium is a disturbing factor in the case. Benzols are very weak; and weak though they are, buyers do not seem to care to commit themselves. Carbolic is better; and business has been done at 2s. 1d. for 60's. Inquiry is also good; and there seems every likelihood of carbolic seeing higher prices.

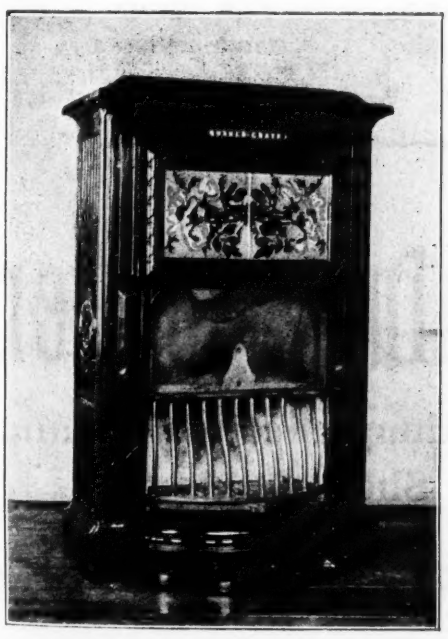
Prices are as follows: Tar, 15s. to 21s. Pitch, east coast, 27s. 6d.; west coast, 25s. Benzol, 90's, nominal, 7d.; 50's, 7½d. Toluol, 10d. Solvent naphtha, 11d. Heavy naphtha, 1s. Crude 30 per cent. naphtha, 3d. Creosote, 3½d. Heavy oils, 60s. Carbolic acid, 60's, 2s. 1d.; 75's, 2s. 9d. Creosote salts, 45s. Anthracene, nominal "A," 4½d.; "B," 3d.

Sulphate of Ammonia has had a good time, and business has been done at prices ranging from £11 5s. to £11 10s, less 3½ per cent. Sales could be effected at these rates for at least a couple of months ahead.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—Recently two questions have very much disturbed the outlook in the coal trade of this district. In the first place, the engine winders demanded a reduction in working hours to eight per day, which the coalowners have decisively declined to entertain; and, in the second place, the weavers asked for an advance of 10 per cent. in wages, which the millowners have also definitely stated they could not grant. Though it can scarcely be said that an actual settlement of these two matters has been arrived at, the probabilities of a stoppage of the pits and a serious strike in the cotton trade have been practically removed by a compromise on both sides, which, in the case of the engine winders, has been partially accepted, and in connection with the cotton trade has been provisionally agreed to. These arrangements necessarily largely affect the immediate prospects of the coal trade, as a stoppage of the pits at the present time would have been a most serious matter; while a strike in the cotton trade, on the other hand, would have considerably interfered with local requirements for engine fuel. With regard to the gas coal trade, no business of any moment has yet been definitely put through, to establish



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prices; and the position may be said to remain practically much as reported recently in these columns. The better qualities of round coal still move off fairly well, and prices are very firm at full list rates; while for steam and forge coals the demand continues brisk, with rather a shortness of supplies. Engine classes of fuel from some districts have been coming in rather more plentifully; but Lancashire collieries for the most part are still short of supplies to meet the requirements of their customers. All round prices are exceedingly strong; and in some cases, on manufacturing classes of fuel, the tendency is to hold out for slight advances on current rates for forward delivery. At the pit, best Wigan Arley averages 12s. to 12s. 6d. per ton, Pemberton four-feet and seconds Arley 10s. 6d. to 11s., common house coal 9s. 6d. to 10s., steam and forge coal 9s., best slack 6s. 6d. to 6s. 9d., medium 5s. 9d. to 6s., and common sorts 5s. 3d. to 5s. 6d. In the shipping trade, rather more business is reported, with somewhat better prices obtainable; ordinary steam coal delivered at the Garston Docks averaging 9s. 9d. to 10s. per ton, and at the High Level, Liverpool, 10s. to 10s. 6d.

Northern Coal Trade.—In this district, trade is slightly easier; and though the collieries are fully occupied, there is not the rush to ship that there was. The opening of the Baltic ports, however, gives an increased demand that will continue. Best Northumbrian steam coals are now quoted 13s. per ton f.o.b., second-class steam about 12s., and steam smalls 7s. 6d. Manufacturing coals are steady in price; and the demand is very full. In gas coals, further supplies have been arranged for, both for home and foreign users; and as far as can be learned, the price is about 8s. to 8s. 3d. per ton f.o.b. under these contracts; while for occasional cargoes of best Durham gas coals the quotation is at times as high as 9s. 3d. per ton. The gas coal consumption is, however, very low now, though the Baltic season will give additional trade to the coal-owners who ship gas coal to the Swedish and other northern ports. There is no alteration in the price of gas coke this week.

Scotch Coal Trade.—Trade is very good, with prices, particularly for ell and splint, still going up. This is partly attributed to the strike of the miners in Belgium; but it is also largely due to the exceptional activity which is at present being experienced in nearly all branches of trade in the United Kingdom. Prices are: Main 9s. 3d. to 9s. 6d. per ton f.o.b. Glasgow, ell 10s. 6d. to 11s., and splint 9s. 9d. to 10s. The shipments for the week amounted to 190,418 tons—an increase of 31,167 tons upon the previous week, but a decrease of 34,694 tons upon the corresponding week of last year. For the year to date, the total shipments have amounted to 2,463,161 tons—a decrease on the same period last year of 59,004 tons.

The Profits of the Nelson Gas Undertaking.—At the meeting of the Nelson Town Council last Wednesday, the presentation of the minutes of the Gas Committee brought out the fact that instead of a profit of £2000, as estimated, on the past year's working, there was a loss of upwards of £800. A heated discussion ensued—one member alleging that there had been leakage and irregularities. Alderman Wilkinson, the Chairman of the Committee, declared that there was a profit, but that it had been spent in extensions. The matter was eventually referred back.

Extension of the Carnarvon Water-Works.—Mr. O. Meade King has held an inquiry at Carnarvon on behalf of the Local Government Board in connection with the application by the Town Council to borrow £3310 for the extension of the water-works. In supporting the application, the Surveyor (Mr. Hall) said that it was proposed to construct an additional reservoir, and to lay down a 10-inch main instead of an 8-inch one to the town; so that the higher parts of the district would be better supplied than they had been. About 2½ acres of land would be required for the reservoir, and a portion of this had already been purchased. With the extension he calculated upon being in a position to supply 15,000 people with 60 gallons of water per head per day. There was no opposition.

Vienna Water Supply.—According to the Vienna correspondent of the "Standard," the city has secured, for the trifling sum of 30,000 florins, water rights from the Alpine district of the Hochschwab, a peak 2278 metres high, with an estimated yield of 16½ million gallons per day. The quality of the water is declared by experts to be equal to that of the present Hochquellwasser, which is taken from the Schneeberg district, and passes for the purest and most delicious drinking water enjoyed by any large town in the world. The quantity already secured for the sum mentioned would not, it is stated, warrant the construction of another aqueduct to Vienna; but as the Burgomaster has an offer of about an equal quantity from the immediate neighbourhood of the Hochschwab, which would supplement the present supply by 33 million gallons per day, it is probable that the Municipal Council will decide upon the construction, which is estimated to cost between 30 and 40 million florins, and, to judge by past experience, will in the end cost 50 millions, or about £4,000,000. The works will take five years to complete.

The Felixstowe District Council and the Water-Works.—At last Wednesday's meeting of the Finance Committee of the Felixstowe District Council, the report of the Finance Committee contained a paragraph in regard to the purchase of the water-works. It stated that the Felixstowe and Walton Water Company had served a notice claiming £75,000 as the price of their undertaking, and giving notice that unless the Council were willing to pay this sum, and forthwith enter into a written agreement for the purpose, they required, within 21 days after receipt of such notice (April 22), to go to arbitration in the manner provided by the Lands Clauses Act. The Council must, therefore, either proceed to agreement or arbitration, or pass a resolution that they altogether abandoned the powers obtained by the Act of last session, and ask the Company to consent to the withdrawing of the notice to treat on paying their costs. The Chairman stated that since the report was published he had received an informal communication, and he wished to propose that the matter be referred to the Finance Committee for further consideration. The communication amounted to this—that an arrangement should be made by which the Council should take over the water-works for a 3d. rate extending over seven years. In recommending this course, he observed that they were now spending a sum for expenses which would come to a 10d. rate. The proposal was adopted; and in reply to a councillor, the Chairman said it was not then necessary that they should come to a decision within 21 days.

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NEW SEASON'S LIST NOW READY

Singapore Gas Company, Limited.—The accounts of this Company for the past year show a somewhat similar result to those of the previous twelve months. The profit is £3561, which, added to £1921 brought forward, makes a total of £5482. After deducting £1355 paid as interim dividend and debenture interest, £2144 absorbed by writing down the stocks and other assets to sterling value, and placing £500 to the contingent fund, a balance is left of £1482, out of which the Directors recommend the payment of a dividend for the past six months at the rate of 3½ per cent. per annum, free of income-tax, which, with the interim dividend paid last November, makes 3 per cent. for the year; leaving a balance of £357 to be carried forward. The Manager (Mr. Albert Ford) reports that the works and plant are in good condition.

The Bradford Extension Scheme.—The Local Government Board have issued to the Bradford Corporation, the District Councils of the areas affected, and other local bodies, their Draft Provisional Order in reference to the extension of the city of Bradford. The Order provides that this shall take effect from the 9th of November next, from which date Eccleshill, Idle, Thornton, Tong, and part of North Bierley, will become part of Bradford. All Local Acts in force in Bradford will apply to the new districts, with certain exceptions. One is that nothing in the Order is to be taken to empower the Corporation either directly or indirectly to supply gas within the limits of supply of the Airedale, the Clayton, Allerton, and Thornton, the Eccleshill and Bolton, the Drighlington and Gildersome, and the North Bierley Gas Companies. Existing officers of the Local Authorities who may suffer any pecuniary loss by abolition of office or diminution or loss of fees or salary, are to be entitled to compensation to be paid by the Corporation.

Incandescent Gas Lighting in Marylebone.—The St. Marylebone Vestry at the last meeting considered a notice of motion by Mr. T. W. Baker, proposing that, inasmuch as it is now indefinite as to when the electric lighting of the main streets may be extended, the cost being prohibitive, the Works Committee should be instructed to ascertain the cost of lighting the main roads with Nos. 2 and 4 Welsbach burners, of the new design, as in use in Camberwell and Lambeth, whereby three times the light is obtained without any increase in the cost. The motion was adopted without discussion. At the same meeting the Works Committee brought up a report relating to a recent instruction requesting them to consider the question of extending the incandescent gas lighting system in the Marylebone Road. After full consideration, the Committee recommended that no further action should be taken for the present. Mr. A. H. Garrould, who moved the adoption of the recommendation, reminded the Vestry that about a year ago they had 24 lamps fixed on the north side of the Marylebone Road, in order to test the system. A Company agreed to maintain the fittings and provide mantles for a charge of 15s. per lamp per annum; and the Vestry thought they had come to a very good arrangement. When the instruction recently came before the Works Committee, he said that there was a feeling that the system should be extended; but they came to the conclusion that it would be better to let the matter remain in abeyance for the present. He therefore moved the adoption of the Committee's recommendation. This was agreed to.

Teignmouth Gas Supply.—A statement was laid before the Teignmouth District Council last Tuesday as to the gas manufactured and sold during the year ended the 31st of March. The total make was 22,596,620 cubic feet; and Mr. Banbury, the Chairman of the Gas Committee, stated that they had carbonized 100 tons of coal less, and yet sold 500,000 cubic feet of gas more than in the preceding year. This, he said, showed the wisdom of laying the new mains.

Sales of Shares.—Last Wednesday, 250 ordinary £10 shares (7 per cent.) in the Exeter Gas Company were offered for sale, and realized an average of £17 10s. each; the minimum price being £17 5s., and the maximum £17 17s. 6d. On Thursday, a few £10 "B" shares in the Eastbourne Gas Company, with the dividend accruing since the 31st of December last, were sold for £25 10s. and £25 12s. 6d. each. At a recent sale by Messrs. Shepherd and Sons, five £10 shares in the Littleborough Gas Company were sold for £25 2s. 6d. each. Last Thursday, Mr. A. J. Waterman disposed of five ordinary 7 per cent. £10 shares in the Maidstone Water Company at £14 10s. each.

The Proposed Municipalization of the Gas-Works at Morecambe.—A public meeting of the property-owners and ratepayers of Morecambe was held last Thursday to consider the proposal of the District Council to apply to Parliament next session for a Bill to take over, by compulsion or otherwise, the undertaking of the Morecambe Gas Company. The Chairman of the Council, Mr. I. J. Miller, briefly moved a resolution approving of the action of the Council, which was carried without a single dissentient. The Morecambe Gas Company were established in 1858, and incorporated in 1879. The share capital consists of £20,000 ordinary, £16,000 6 per cent. perference, and £6500 loans on mortgage. The last dividend was one of 12 per cent.; and the ordinary shares are quoted at £244. The Company recently obtained a Provisional Order from the Board of Trade sanctioning an increase of capital; the Morecambe District Council unsuccessfully opposing.

Pumping by Aid of the Wind.—Last Thursday, Colonel C. H. Luard, one of the Local Government Board Inspectors, held an inquiry at Hundon into an application by the Clare Rural District Council for permission to borrow £1400 for works of water supply for Hundon. Dr. Armistead, the Medical Officer of Health, and Mr. W. H. Carr, the Inspector of Nuisances, both spoke as to the necessity of a water supply to the parish, which at present has to depend upon wells. It is proposed to construct a deep well to reach the chalk water, and to erect a powerful wind motor, 20 feet in diameter and 20 feet high, to raise the water. It was stated that, with a moderate wind, it would develop 5-horse power, and a motor with a 4-inch double-barrel force pump and a 3-inch raising main would be capable of lifting more than 1000 gallons of water per hour to the required height. Auxiliary horse-gear apparatus would be provided for use in calm weather. They proposed to store the water near the well, in a covered service reservoir, constructed of portland cement, concrete, and clay puddle, covered with a concrete and iron girder roof, capable of holding 25,000 gallons. To convey the water by gravitation from the reservoir to the various parts of the village, 3-inch cast-iron mains would be used.

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The Huddersfield Gas Profits.—It was reported in last week's issue that the Huddersfield Town Council had agreed to devote the surplus on the gas undertaking to the relief of the rates; it being anticipated that the profits would equal a threepenny rate. The surplus, it now transpires, will be equal to a threepenny rate and leave £4700 to go to a reserve fund.

The Manufacture of Sulphate of Ammonia by the Manchester Corporation.—The "Manchester City News" states that the Corporation Gas Committee have decided to manufacture their own sulphate of ammonia. Buildings will be erected at the Bradford Road Gas-Works; and the ammoniacal liquor will be conveyed in pipes from the Rochdale Road works and by tank-barges along the canal from the Gaythorn works. Hitherto the liquor has been bought by local contracting firms who have manufactured it; and it is partly in consequence of complaint as to alleged nuisances arising from the private manufacture, that the Committee have taken this step.

The Charge for Public Lighting at West Bromwich.—At the meeting of the West Bromwich Town Council last Wednesday, the Gas Committee reported that they had given careful consideration to the request of the Highway Committee for a revision of the charges for public lighting; and, in view of the fact that at the present time it involves a loss to the Gas Department, they regretted that a revision of the existing prices in the direction of a reduction was impracticable. They explained that the charges were based on those prescribed in the Act of Parliament; having been originally fixed with the object of enabling the Lighting Authorities in the late Birmingham and Staffordshire Gas Company's district to obtain public lighting as nearly as possible at cost price. A comparison, moreover, of the lighting charges in West Bromwich with those of a number of other boroughs similarly situated showed that the former were, generally speaking, lower—regard being had to consumption of gas and the number of lighting hours. The report was adopted.

The Award in the Clacton Gas and Water Arbitration.—At the meeting of the Clacton Urban District Council last Wednesday, the Water Committee reported that the award of the Umpire in the above-named arbitration (Mr. G. H. Hill) had now been taken up, fixing the price to be paid by the Council to the Gas and Water Company for their undertaking at £48,400. To this had to be added £12,500 in respect of mortgages, and £4000 compensation to Directors, officers, &c., which, with £21,500 the estimated cost of the new scheme of water supply, £5000 for improvements and additions to the gas-works, and £10,000 expenses incurred in obtaining the Act, completing the purchase, arbitration, and other matters, make a total of £101,400. The Committee had given the Council instructions to arrange for the raising of this sum by the issue of stock. The only suggestion which the Company had ever made as to price was at the conference in 1896, when the figure mentioned was £100,000. The Committee submitted, therefore, that the result of the arbitration (see *ante*, pp. 597, 678) was satisfactory, and showed that it was practically impossible to avoid it by purchasing at an agreed price. The revenue for 1898, after paying all expenses, was stated to be £2540; but the Committee hoped that when the undertaking was in the hands of the Council the net revenue might approach £3000.

Reductions in Price.—The Stone Gas Company have decided to reduce the price of gas supplied to the District Council to 2s. 10d. per 1000 cubic feet from the 25th ult. The Wilmslow and Alderley Edge Gas Company have decided to reduce the price of gas from 3s. 2d. to 2s. 11d. per 1000 cubic feet as from the 31st of March. The Malton Gas Company are reducing the price of gas from 3s. to 2s. 9d. per 1000 cubic feet. It has been at the former figure for nearly ten years.

Ashford Water Supply.—Last Tuesday, Colonel W. R. Slacke held an inquiry, on behalf of the Local Government Board, into an application by the Ashford District Council for permission to borrow £8000 for purposes of water supply. The scheme has for its object the purchase of Henwood Farm on which the Council's wells are situated, and the carrying out of certain work in connection with the town supply. Mr. J. Creery, the Clerk to the Council, furnished details; and Mr. W. Terrill, the Surveyor, said the total quantity of water pumped during the year ended Dec. 31, 1898, was 45,548,396 gallons—giving a weekly average of 875,930 gallons. The minimum daily consumption was 62,052 gallons, on April 10; and the maximum, 178,200 gallons, on July 16. There was no opposition.

New Joint-Stock Companies.—The Manningtree and Mistley Gas Company, Limited, has been registered with a capital of £10,000, in £5 shares, to acquire and carry on the business of the Manningtree and Mistley Gaslight and Coke Company, Limited. The Acetylene Lighting Company of Birmingham, Limited, has been formed with a capital of £3000, in £1 shares, with an object sufficiently indicated by the title. The Intensified Gas-Light Company, Limited, has been registered with a capital of £100,000, in £1 shares, to adopt and carry into effect an agreement expressed to be made between the Somzée-Greyson Intensified Gas-Light Syndicate, Limited, and the Company, and generally to carry on business as manufacturers of, and dealers in, lamps, burners, mantles, and other materials required in connection with producing and measuring light or illumination, incandescent or otherwise, or heat; also gas-fittings generally, and appliances for electric lighting and fitting.

Bradford Plumbers and the Fixing of Gas-Stoves.—The plumbers of Bradford are (says the "Bradford Observer") complaining that the Corporation, by deciding to fix gas-stoves in private houses, will unduly compete with them; and by means of a deputation, they laid their grievance before the Gas Committee last Friday. Municipal trading is a problem that has been much discussed of late; and in some instances weighty considerations have been urged against it. In this particular matter, however, the Bradford plumbers appear to have a very weak case. The Corporation do not propose to sell gas-stoves outright, but merely to let them on hire for the convenience of small consumers. They will remain the property of the Corporation, and will consume the Corporation gas; and therefore it is not unreasonable the Corporation should desire to retain the fixing of the stoves in their own hands. Indeed, it would be somewhat anomalous if a third person were to be called in. The Corporation scheme does not prevent any person buying a gas-stove of whom he pleases, and engaging any plumber to fix it. The Gas Committee rightly decided to adhere to their scheme.

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WINDSOR STREET WORKS, BIRMINGHAM (Second Contract)	2,000,000
HALIFAX	1,000,000
TORONTO	250,000
OTTAWA	250,000
LINDSAY (Remodelled)	125,000
MONTREAL	500,000
TORONTO (Second Contract; Remodelled)	2,000,000
BELLEVILLE	250,000
OTTAWA (Second Contract)	250,000
BRANTFORD (Remodelled)	200,000
ST. CATHERINES (Remodelled)	250,000
KINGSTON, PA.	125,000
PETERBOROUGH, ONT.	250,000
WILKESBARRE, PA.	750,000
ST. CATHERINES (Second Contract)	250,000
BUFFALO, N.Y.	2,000,000
WINNIPEG, MAN.	500,000
COLCHESTER (Second Contract)	300,000
YORK	750,000
ROCHESTER	500,000
KINGSTON, ONT.,	300,000
CRYSTAL PALACE DISTRICT	2,000,000
DULUTH, MINN.	300,000
CATERHAM	150,000

AND ADDITIONAL WORK.

The Aldeburgh Town Council and the Water-Works.—Last Friday, the Aldeburgh Town Council approved of the recommendation of a Committee that the common seal be affixed to a draft provisional agreement for the purchase of the Water Company's rights, and that steps be taken to obtain the approval of the Local Government Board.

Proposed New Gas-Works for Blackburn.—The Gas Committee of the Blackburn Corporation have resolved to construct new works at Greenbank; the site of the present No. 1 station being required for extensions in connection with the Electricity Department. Application will therefore be made to the Local Government Board for sanction to borrow £50,000 for the new gas-works. The scheme was approved of at the last meeting of the Town Council.

New Pumping Plant at the Ormskirk Water-Works.—Last Wednesday the members and officials of the Ormskirk District Council took part in a ceremony at the water-works in connection with the new vertical engine, which, with alterations to the engine-house, has cost about £1000. The engine is 16½-horse power, and will pump about 20,000 gallons per hour. As the daily requirements of the town are about 120,000 gallons, the water-works are now in a position to meet all demands for many years to come. Mr. R. Walker, the Chairman of the Council, started the engine.

Great Wigston Gas Company.—Increased consumption of gas still goes on at Great Wigston. For the quarter ending the 31st of March, it was 1,181,000 cubic feet, or 18 per cent. more than last year. There are 310 prepayment meters fixed, and the demand still goes on; the meter, with service-pipe, connections, and a cooker, being fixed rent free. The make of gas will be close upon, if not quite, 30 million cubic feet this year; whereas fifteen years ago it was 3 millions. The old sulphate plant has been replaced by one of Messrs. C. & W. Walker's latest types, and a new and larger sulphate-house is at once to be erected. About sixty new consumers have had meters fixed so far this year; the number of additional customers for 1898 being 126. Dividends at the rate of 7½ and 5 per cent. were paid at the last half-yearly meeting, when the Manager (Mr. John A. Harris) received the special thanks of the Directors and shareholders.

Progress of the Wilmslow Gas Company—At a meeting of the Directors of the Wilmslow and Alderley Edge Gas Company last Tuesday, it was decided, owing to the very satisfactory report presented by the Engineer and Manager (Mr. W. Severs), to reduce the price of gas from 3s. 2d. to 2s. 11d. per 1000 from the 31st of March; also to let out grillers free, and to lay services and fix prepayment meters free, giving 25 cubic feet of gas for 1d. Extensive alterations, owing to the increased demand for gas, are now in hand, consisting of new coal-store, &c.; also for four 18-feet purifiers, purifying-house, lime-store, and new Cornish boiler. The whole of this work has been entrusted to Messrs. R. Dempster and Sons, Limited, of Elland. It is gratifying to note that the Directors expressed their high appreciation of their Manager's services by advancing his salary £25 per annum; this being the third similar advance since his appointment in July, 1897.

East Dereham Water Supply.—The East Dereham District Council are proposing to raise a loan of £2350 to be spent in extensions and alterations at the water-works. Colonel J. T. Marsh, of the Local Government Board, has lately inquired into the application of the Council for permission to obtain the sum named; and there was only one objector, who contended there was no need to acquire additional land, but agreed that supplementary pumping machinery was required.

Improvements at the Holmfirth Gas-Works.—Some few years have elapsed since any alterations were made at the works of the Holmfirth Gas Company; and when the present Engineer and Secretary (Mr. Hubert Russell) entered upon his duties last July he found the plant in anything but a satisfactory condition. The result of this was complaint by the consumers during the past winter. Mr. Russell consequently suggested to his Directors certain necessary improvements at the works; and his proposals have been agreed to in their entirety. In the first place, the existing retorts are too small, and it is intended to have a new bench on Drake's regenerative principle. Beyond this, in the course of the coming summer the works will be entirely reconstructed on the latest principles, and brought up to date. The alterations will be carried out by Mr. Russell, who hopes that as the result he will not only be able to improve the quality of the gas, but reduce its price, and by an increased sale recoup the Company for the outlay incurred.

The Management of the Longton Gas-Works.—A quarterly meeting of the Longton Town Council was held at the Town Hall last Thursday—the Mayor (Alderman A. Edwards) presided. In the minutes presented by the Gas and Electricity Committee, it was stated that the question of the management of the gas-works had been investigated. The Committee reported that the Manager of the works (Mr. W. S. M'Gregor) had resigned, and that the Committee had decided to advertise for a Manager at a salary of £250 per annum, and also for a Secretary and Cashier at a salary of £150 a year. They also recommended that the office staff should be re-arranged, and that the appointment of the Manager and Secretary and the re-arrangement of the staff should be left with the Committee. Mr. A. S. Walters moved the adoption of the report. A special report upon the affairs of the gas-works, it was stated, had been prepared and sent to each member of the Council privately. Mr. Preece said this special report had only been received by the members of the Council that morning, and they had not had time to study it. As far as he could make out, it was an attempt to "whitewash" the Manager. He moved, as an amendment, that the reports of the Committee should be considered at a special meeting of the Council to be called as early as possible. Mr. Walters said no good would come of referring the matter to a special meeting. The report was simply a record of facts, and could not be altered if it were referred back. The only recommendations were in favour of splitting up the offices of Manager and Secretary, and the rearrangement of the office staff. The amendment was lost. Mr. G. Bloor then moved that the Manager be paid his salary and at once dismissed. This, however, did not find a seconder. Mr. Jolly said he did not think the Manager was altogether to blame; the Committee were also at fault. After further discussion, the report of the Committee was adopted.

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Expensive Foundations at the Knottingley Water-Works.—Major Tulloch, of the Local Government Board, held an inquiry last Friday at Knottingley into an application by the District Council for power to borrow £1200 for additional expenditure incurred in the carrying out of the water scheme, for which a loan of £7500 had already been sanctioned. Mr. Richardson, the Engineer, explained that the extra outlay had been occasioned entirely through a misconception of the nature of the foundations of the water-tower, which, instead of costing £2200, had actually taken £3967.

A Gas-Rate War in New York.—A special correspondent of the "Glasgow Herald" wrote as follows last Wednesday: "All the various Companies which supply Greater New York with gas are just now engaged in a remarkably embittered war of rates, from which the delighted citizens are reaping substantial benefits already, with a good prospect of more to come. Until a week ago, the general charge for gas was $1 10c. per 1000 cubic feet. To-day the charge is only 50c.; and the struggle is so fierce that further reductions are regarded as certain. The shareholders in the Companies are greatly alarmed, and are calling for a cessation of the suicidal policy upon which the Directors have embarked without adequate justification."

The Newcastle Corporation and the Gas Company.—Some pertinent questions were put by Alderman Bell to the Chairman of the Estate and Property Committee, at the meeting of the Newcastle Town Council last Wednesday, regarding the land acquired from the Corporation by the Gas Company for their new works at Walker. He desired to know the price asked by the Corporation, and what was the amount awarded in the arbitration. Also whether, before going to arbitration, the Gas Company made any offer, or whether any negotiations took place. Further, if the Corporation possessed any information as to the price agreed upon by the Gas Company for adjacent land; and what were the Corporation's costs of arbitration. Alderman Stout said the price asked was £45,000; and the arbitration award was £18,500. The Gas Company never made any offer; and therefore no negotiations took place. Lord Northbourne sold the adjacent land, 46 acres, for £30,000—about £680 per acre. The Corporation's costs amounted to £1350; and the costs paid by the Gas Company to the Corporation were £534. Alderman Stephenson said the bill of costs presented amounted to £1600; the amount awarded by the taxing master was £500; and the difference between £500 and £1600 was what the Corporation had to pay. Alderman Bell wished the matter discussed; but the Council declined.

Manchester Gas and Electricity Departments.—Mr. James Bower, one of the representatives of Miles Platting in the Manchester City Council, has had an address presented to him by his constituents, in recognition of his twenty-five years of political and public work. In his municipal career, he has served with some distinction on the Gas and Electricity Committees; and reference was made to this in the address. In expressing his gratitude for this mark of the appreciation of his constituents, he said, speaking of the Gas Committee, that in 1890 the price of gas in Newton Heath was 3s. 2d. per 1000 cubic feet. On amalgamation, the charge was reduced 6d.; and it had been further brought down to 2s. 3d., together with the abolition of meter-rents, which he had the pleasure of moving in Committee. He had proposed another resolution, which, he thought, would be eventually carried, respecting the discontinuance of charges for the use of cookers. Whenever the price of gas had been reduced, there had been a loss for the time being; but the consumption had increased so rapidly that they had always recouped themselves within two-and-a-half years. During the last nine years, they had been able to place to the credit of the ratepayers the sum of £52,000 per annum out of the profits, as well as keep their plant in perfect condition. The Electricity Committee was a very young Committee; but no Committee had made greater strides and lent itself so well to public requirements. Their plant expenses had certainly been very great; but the price had been reduced once, and probably would be again, so as to bring the electric light more within the reach of everybody. Last year they were able to place to the credit of the rates the sum of £12,000, which was equal to about 1d. in the pound. Just now they were again increasing their plant. They had now working a 2500-horse power engine, which was one of the largest in England. Orders were recently given for considerable extensions at their present works; and further plans and specifications were being prepared for another very large station. Here they would generate sufficient power to work the whole of the electric tramways of the city, and also to light the whole of the northern part of it.

A New Water-Main for the Supply of Salford.—The Salford Corporation last Wednesday agreed to a proposal, submitted by Alderman Shaw, that the Water Committee be authorized to arrange with the Manchester Corporation for laying a 24-inch main, from the Gorton reservoir to Regent Road Bridge, capable of delivering an ample supply of water for the borough for present and prospective demands, at an estimated outlay of £25,000, entailing an annual cost of £1125 to the borough. The proposed outlay, Alderman Shaw said, was only consistent with the growing requirements of the town; the present supply being obtained through an 18-inch pipe.

Kingskerswell Water Supply.—Under an agreement with the Newton Abbot Rural District Council, the Torquay Corporation are about to furnish a supply of water to the village of Kingskerswell. The District Council are to lay the mains and provide a reservoir to hold 60,000 gallons. These works are estimated to cost £2000; and an inquiry has just been held by Colonel Hepper, of the Local Government Board, respecting an application for power to borrow the money. It was stated that the question of the water supply of the village had been under consideration for twenty years. Torquay is to be paid 1s. 8d. per 1000 gallons for the water, subject to a discount of 40 per cent. if the minimum consumption per year is at the rate of 5500 gallons per day.

West's Gas Improvement Company, Limited, have recently received a large order from the Smelting Corporation, Limited, of Ellesmere Port, Cheshire, for constructional steel and iron work and elevators for dealing with zinc and dolomite; and for coal breaking, elevating, and storing machinery for the East Greenwich Gas-Works.

An amalgamation has taken place between Messrs. Arden Hill and Co., Limited, and the Eagle Range and Foundry Company, Limited, of Birmingham, and the business will in future be carried on under the style of the Eagle Range and Gas-Stove Company, Limited. The addresses of each works will be as heretofore; but the gas-stove manufactory will in future be known as the "Acme" Gas-Stove Works instead of the Etna Gas-Stove Works. Mr. H. James Yates will continue to be Managing-Director. The Company have show-rooms in Birmingham, Manchester, Bristol, and London.

The New Conveyor Company's new iron and steel foundries are nearing completion; and Mr. E. Lewis, formerly Manager of the chain and general foundries of the Jeffrey Chain Belt and Conveyor Company of New York, has been appointed to fill a like position at Smethwick. The Burslem Corporation have accepted the tender of the first-named Company for a new retort-house and coal-store, to be entirely automatic, and the retorts to be heated by "Eclectic" furnaces. Contracts for large installations of the "Smethwick" conveyors for batteries of gas-producers and coke-ovens have also been placed by the Barrow Hematite Steel Company, and the Steel Company of Scotland.

The Directors of Meters Limited, in their report for the year ended March 31 last, state that the trading has resulted in a gross profit of £30,023, which is reduced by general management expenses, Directors' fees, legal charges, expenses on patents, income-tax, and depreciation. A sum of £1800 has been spent out of revenue on repairs and renewals. After providing for interest on debenture stock (£6361) the net profit amounts to £15,913, out of which the Directors recommend a dividend at the rate of 5½ per cent. per annum upon the preference shares, and 5 per cent. per annum upon the ordinary shares, and that the balance of £2046 be written off the formation expenses.

The following exhibitions of gas appliances have lately been held: By the Davis Gas Stove Company in the Hannah More Hall, Bristol, with lectures by Miss M. E. Betts. By Messrs. R. & A. Main at Birkdale, with lectures by Miss Baines; and at Lockwood, with lectures by Miss Bennett. By Messrs. Richmond and Co., Limited, at Airdrie, Eccles, Hay, Kirkby Stephen, and Stockport (a special feature at each place being a complete "slot" installation), with lectures by Misses Richmond, Smallwood, and Barker. By Messrs. John Wright and Co., Limited, at Holmfirth, with cookery lectures. Messrs. Fletcher, Russell, and Co., Limited, and Messrs. John Wright and Co., Limited, held a joint exhibition at the Albert Hall, Torquay, last week, with very successful results. An important adjunct to the exhibition was a series of lectures on cookery delivered by Miss M. Ellery, daughter of Mr. C. Stafford Ellery, of Bath. The arrangements for the exhibition were in the hands of Mr. John Duckworth and Mr. A. T. Osman, officials of the Torquay Gas Company.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of, PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAY.

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[For Illustrated Advertisement, see p. 1182.]

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Information and Handbook on application.
70, CHANCERY LANE, LONDON, W.C.

AMMONIACAL LIQUOR wanted. BROTHERTON AND CO., Ammonia Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

IMPORTANT.
REPAIR your old Retorts with Patent STICKFAST FIRE CEMENT. Unequalled for Repairing Inclines. Estimates for all kinds of Retort-Settings.
Write CROWTHER, Retort Setter, and Sole Maker of Stickfast Fire Cement, Manor Street, HUDDERSFIELD.

GAS TAR wanted. BROTHERTON AND CO., Tar Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

GAS CARBON Wanted, not less than 4-Ton Loads.
Apply to the BIRMINGTON CARBON COMPANY, Bowerby Bridge, YORKS.

PRACTICAL RETORT SETTER.
GEORGE NUTTALL, 32, Havelock Road, Saltley, Birmingham.
Regenerator or other Furnaces erected to Engineers' own Designs. Best Work Guaranteed. Please write for Estimates.

SPENT OXIDE wanted. BROTHERTON AND CO., Chemical Manufacturers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

SULPHATE OF AMMONIA SATURATORS.
JOSEPH TAYLOR & CO., Chemical Plumbers, &c., and Makers of every description of Solid Plate Lead and Timber Cased Saturators, &c., CENTRAL PLUMBING WORKS, TOWN HALL SQUARE, BOLTON. Special attention to Repairs.
Before placing Orders, please write for Estimate.
Telegraphic Address: "SATURATORS, BOLTON."

ECONOMY IN PURIFICATION.
INCREASE the efficiency of your PURIFIERS by adopting CRIPPS'S PATENT BYE-PASS VALVE in the lower Tiers of Sieves. Practical Experience proves their Economy. Engineers are repeating orders after thorough trial.
References and Particulars can be obtained from the Makers—
C. & W. WALKER, Midland Iron-Works, Donnington, near Newport, SALOP.

ADVERTISER (aged 27) seeks Situation in a Gas-Works as METER REPAIRER and TESTER. Can fill up spare time with Gas-Fitting. Twelve Years' Experience in Gas-Works. South of England preferred.
Address No. 3253, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TO GAS COMPANIES, &c.
WANTED, by a practical Working MANAGER, the Management of a Gas-Works where the Annual make of Gas is from 10 to 20 Millions. Has had practical Experience in the Construction, Erection, and Maintenance of Gas-Works, and the Manufacture and Distribution of Gas in all its branches. A change desired. Excellent References and Testimonials.
Address No. 3253, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, for Gas-Meter Works in the Provinces, a thoroughly competent MANAGING FOREMAN.
Apply, by letter, to No. 3258, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WORKING Foreman wanted for small Country Water-Works. Must be thoroughly competent to Tap Mains, Lay Services, Mains, &c.
Send full Particulars, with *copies* only of Testimonials, to K. T., care of GOULD'S ADVERTISING OFFICES, 54, NEW OXFORD STREET, W.C.

WANTED, two Carbonizing Foremen, accustomed to Regenerative Furnaces and Inclined Retorts.
Apply, by letter, enclosing *copies* of three recent Testimonials as to Character and Abilities, to No. 3227, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

GENERAL Foreman required at large Gas-Works, age about 30. Good mechanical training and knowledge of Gas Plant generally essential.
For further Particulars, apply, by letter, to No. 3269, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Stoker. Shovel Charging. Eight-hour Shifts, four Months; Twelve-hour Shifts, eight months. Wages 28s. Other privileges.
State Age, Height, and if Married. Must have done Stoking in a Retort-House.
Apply to the MANAGER, Gas Company, DARTMOUTH.

WANTED, a Yard and Retort-House FOREMAN. Maximum daily make about 900,000 cubic feet. State Age, if Married or Single, and Wages required.
Send, by post, *copies* of three recent Testimonials, to No. 3260, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

ENERGETIC and Capable Man required with practical knowledge of Gas-Stoves, Fittings, &c., to act as Gas Company's SALESMAN. Must be able to Estimate, keep Books, advise Customers, and generally manage Sales Department. Within 50 miles of London.
Apply, by letter, stating Age, Salary, and Experience, to No. 3267, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

SECRETARY.
WANTED, by a leading firm of Gas-Stove Manufacturers, an energetic Gentleman to undertake SECRETARIAL duties in London, and to receive Clients in Principal's absence. Commencing Salary, about £200.
Address, stating Age, Experience, Salary, and Connection, No. 3270, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

GAS AND WATER MANAGER.
WANTED, Gas and Water Managers for the Burgh of Elgin. Salary of Gas Manager to be £150 per annum, with free House and Garden and Fire and Light; and of Water Manager, £50 per annum. The appointments may be conjoined or filled separately as ultimately determined.
Applications, with Twenty printed *copies* of Testimonials, to be lodged with HUGH STEWART, Town Clerk, ELGIN, on or before the 13th of May next.

DRAUGHTSMAN.
WANTED, for a Gas and Water Works, a practical Man as DRAUGHTSMAN and CLERK OF WORKS. Must be experienced in Building and Plant Construction. Permanent berth to a suitable Man. Salary 50s. per week.
Applications, with Particulars of Experience, and *copies* of not more than three Testimonials, to be sent, not later than the 16th inst., to No. 3268, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

A PRIVATE Firm of Sulphate Makers are desirous of making CONTRACTS with Gas Companies for the purchase of the whole or part of their AMMONIACAL LIQUOR.
Those Companies having any for disposal either now or in the future kindly communicate with No. 3256, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

CONDENSERS WANTED.
WANTED, a good set of second-hand ANNULAR or VERTICAL PIPE CONDENSERS, suitable for a Gas-Works making from 20 to 30 Million cubic feet of Gas per annum.
State, by letter, Price, with full Particulars, to No. 3254, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
J. F. BLAKELEY, Gas Engineer, Thornhill, DEWSBURY.

THE Wolverhampton Gas Company have FOR SALE, at their Horsley Fields Works, the following SECOND-HAND PLANT comprising: Retort-Fittings, Two Exhausters, Two Steam-Engines, Two Boilers, Two Sets of Vertical Cast-Iron Condensers, Two Scrubbers about 25 ft. by 7 ft., Station Meter, Governor, Cast-Iron Tanks, Weighing-Machine, Roof Principals, &c.
The above can be seen by appointment.
For further Particulars apply to the MANAGER, Gas Company, WOLVERHAMPTON.

GAS-FITTERS' TOOLS — Stocks and Dies (⅛ to ¾), Pipe Cutters, Vices, Tongs (1 in. to 4 in.), Pliers, Saws, Hammers, Augers, &c.; mostly new, and some slightly soiled. FOR SALE, cheap.
Address, No. 3265, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE, at the Yeadon Gas-Works—
MOUTHPIECES, 19 in. by 14 in.; Lids, Cross-Bars, &c., complete.
ASCENSION, H, and DIP-PIPES, 5-inch.
Wrought-Iron HYDRAULIC MAIN, 29 ft. long, and 14 ft. 6 in. long, 20 in. by 18 in.; also one length, 14 ft. 7 in. long, 21 in. by 17 in., all U-shaped.
Five lengths of Cast-Iron HYDRAULIC MAIN, 7 ft. 6 in. each, 18 in. by 18 in.; also
Five lengths of Cast-Iron HYDRAULIC MAIN, 7 ft. 8 in. each, 20½ in. by 16 in., all U-shaped, the whole arranged for Five Retorts in a Setting.
FURNACE FRAMES, DOORS, BUCK-STAVES, &c., &c.
For further Particulars, apply to the MANAGER, Gas-Works, Yeadon, LEEDS.

FOR SALE, at the Hednesford Gas-Works, Staffs., the following Second-hand Plant:—
Oval MOUTHPIECES, with Lids complete, 18 in. by 21 in. and 15 in. by 18 in.
ASCENSION, H, and DIP PIPES, 6 inch.
HYDRAULIC MAINS, 24 in. by 24 in. and 18 in. by 18 in.
Set of 6-inch CONDENSERS.
ENGINE and EXHAUSTER, 5000 cubic feet per hour.
LIVESEY WASHER, with 8-inch Connections.
TOWER SCRUBBER, 3 ft. 6 in. diameter, and 15 ft. high, with 6-inch Connections.
Two PURIFIERS, 12 ft. by 12 ft. by 4 ft. 6 in., with Lifting Gear, and 6-inch Valves and Connections.
One Round STATION METER, to pass 6000 cubic feet per hour
For further Particulars, apply to the MANAGER, Gas-Works, Cannock, STAFFS.

HAYWARDS HEATH URBAN DISTRICT COUNCIL.

TENDERS FOR COKE BREEZE.

THE above Council invite Tenders for the supply of 80 Tons of fine COKE BREEZE screened to ½-inch Mesh. The whole to be delivered, carriage paid, to Haywards Heath Station.
Tenders must be sent to me on or before the 16th day of May inst., endorsed "Tender for Coke Breeze."
A sample of the Coke Breeze must also be sent to me, carriage paid, on or before the 16th inst.
The Council do not bind themselves to accept the lowest or any Tender.

EDWARD WAUGH,
Clerk.

Haywards Heath,
May 4, 1899.

TO TAR DISTILLERS AND OTHERS.

THE Corporation of Birkenhead invite OFFERS for the purchase and removal of the SURPLUS TAR produced at their Gas-Works during a period of One, Three, or Five Years, commencing on the 1st of July, 1899.
Deliveries will be made at the Gas-Works either into Contractor's Tanks on the Gas-Works Railway Siding or into Tanks for conveyance by road to Boats.
The Contractor whose Tender is accepted will be required to enter into a formal Contract or Agreement with the Corporation, upon the specific terms and conditions contained in the Draft Contract which has been prepared by the Town Clerk, and deposited in his Office for inspection.
Forms of Tender and further Particulars may be obtained from the Gas Engineer, Mr. T. O. Paterson, C.E., Gas-Works, Thomas Street.
Tenders, which must be on the printed form supplied, sealed and endorsed "Tender for Tar," to be sent in to me not later than Five p.m. on Friday the 26th of May, 1899.
The Corporation do not bind themselves to accept the highest or any Tender.

By order,
ALFRED GILL,
Town Clerk.

Town Hall, Birkenhead,
May 4, 1899.

TO MANUFACTURING CHEMISTS AND OTHERS.

THE Corporation of Birkenhead invite OFFERS for the purchase and removal of the AMMONIACAL LIQUOR produced at the Gas-Works, for a period of One, Three, or Five Years, commencing on the 1st of July, 1899.
A pipe is laid between the Gas-Works and the River Mersey for the conveyance of Liquor into the Contractor's Boats, or, if desired, the Corporation will provide appliances on their own Railway Siding to pump the Liquor direct into the Contractor's Tank-Waggons.
The Contractor whose Tender is accepted will be required to enter into a formal Contract or Agreement with the Corporation, upon the specific terms and conditions contained in the Draft Contract which has been prepared by the Town Clerk, and deposited in his Office for inspection.
Forms of Tender and further Particulars may be obtained from Mr. T. O. Paterson, C.E., Gas Engineer, at the Gas-Works, Thomas Street.
Tenders, sealed and endorsed "Tender for Ammoniacal Liquor," to be sent in to me not later than Five p.m. on Friday, the 26th of May, 1899.
The Corporation do not bind themselves to accept the highest or any Tender.

By order,
ALFRED GILL,
Town Clerk.

Town Hall, Birkenhead,
May 4, 1899.

FARNWORTH AND KEARSLEY GAS COMPANY.

THE Directors of the Farnworth and Kearsley Gas Company are prepared to receive TENDERS for the surplus TAR and AMMONIACAL LIQUOR produced at their Works, together or separately, for One Year.

Sealed Tenders, addressed to the Chairman, J. W. Watkinson, Esq., to be delivered on or before Wednesday, May 24.

Forms of Tender or any further Information required may be obtained from the undersigned.

THOMAS LEA SHEPPARD,
Manager.

TONBRIDGE GAS COMPANY.

TENDERS FOR PIPES.

THE Directors of the above Company invite TENDERS for the supply of 360 Tons of 6-inch and 7-inch CAST-IRON PIPES, TEES, BENDS, SYPHONS, &c.

Particulars and Specification may be obtained on application.

Tenders, to be endorsed "Tender for Pipes," to be delivered to the undersigned not later than Friday, June 2 next.

The Directors do not bind themselves to accept the lowest or any other Tender.

JAMES DONALDSON,
Secretary and Engineer.

COUNTY BOROUGH OF SALFORD.

(GAS DEPARTMENT.)

TENDERS FOR COAL AND CANNEL.

THE Gas Committee invite Tenders for the COAL and CANNEL required at their Works during a period of One Year.

Forms of Tender may be obtained on application to the Gas Engineer, Gas Offices, Bloom Street, Salford.

Sealed Tenders, endorsed "Tender for Coal," addressed to the Chairman of the Gas Committee, to be delivered to me before Three p.m., on Thursday, May 18, 1899.

By order,
L. C. EVANS,
Town Clerk (*pro tem.*).

Town Hall, Salford,
May 6, 1899.

COUNTY BOROUGH OF SALFORD.

(GAS DEPARTMENT.)

THE Gas Committee invite Tenders for the supply and erection of two TRAVELLING CRANES required at their Liverpool Street Works.

Copies of the Drawing, Specification, and Form of Tender may be obtained (for which a charge of £1 will be made, to be returned on receipt of *bond-fide* Tender) by applying to the Gas Engineer, Gas Offices, Bloom Street, Salford.

Sealed Tenders, endorsed "Tender for Cranes," addressed to the Chairman of the Gas Committee, Town Hall, Salford, to be delivered to me not later than Ten a.m., on Wednesday, May 24, 1899.

The lowest or any Tender will not necessarily be accepted.

By order,
L. C. EVANS,
Town Clerk (*pro tem.*).

Town Hall, Salford,
May 6, 1899.

URBAN DISTRICT COUNCIL OF LYMM.

(GAS DEPARTMENT.)

THE above Council are prepared to receive TENDERS for the supply of CANNEL and best screened GAS COAL, to be delivered at their Gas-Works in Lymm, for a term of One Year from the 1st day of July, 1899.

The probable quantities required will be about 100 Tons of Cannel, and about 1300 Tons of Gas Coal, which must be freshly wrought, well screened, and free from Sulphurous Pyrites or other objectionable matter; but the Council reserve the right of increasing or decreasing the quantities named.

The person whose Tender is accepted will be required to enter into an Agreement with the Council for the due performance of his Contract.

Sealed Tenders, stating Price per ton delivered alongside the Works, to be sent to the Chairman, Urban District Council Offices, Lymm, on or before the 18th day of May, 1899, and endorsed "Coal Tender."

The Council do not bind themselves to accept the lowest or any Tender.

Forms of Tender are not supplied.

Further Particulars may be had on application to
ROBERT SURTEES,
Manager

Gas-Works, Lymm, Cheshire,
April 28, 1899.

URBAN DISTRICT COUNCIL OF LYMM.

(GAS DEPARTMENT.)

THE above Council are prepared to receive TENDERS for the purchase of the surplus TAR and AMMONIACAL LIQUOR made at their Gas-Works, for a term of One Year from the 1st day of July, 1899.

The Tar and Liquor will be delivered free into Contractor's Boat on the Bridgewater Canal.

The Purchaser will have to enter into an Agreement with the Council for the due performance of his Contract.

Sealed Tenders, stating price per ton for Tar and price per ton for Liquor (5° Twaddel) to be sent to the Chairman, Urban District Council Offices, Lymm, on or before the 18th day of May, 1899, endorsed "Tar Tender."

The Council do not bind themselves to accept the highest or any Tender.

Further Particulars may be had on application to
ROBERT SURTEES,
Manager.

Gas-Works, Lymm, Cheshire,
April 28, 1899.

CANTERBURY GAS AND WATER COMPANY.

TENDERS FOR GAS COALS.

TENDERS are invited for the supply of 14,000 Tons of the best NEWCASTLE GAS COALS, to be delivered during One Year commencing on the 1st of June next.

Forms of Tender containing Particulars and Conditions of the Contract may be obtained on application to the undersigned.

Sealed Tenders, endorsed "Coals," to be delivered at the Company's Offices, Castle Street, Canterbury, on or before Saturday, the 13th of May next.

By order,
JAMES BURCH,
Secretary.

April 18, 1899.

BOROUGH OF HAVERFORDWEST.

THE Corporation are prepared to receive TENDERS for the purchase of their surplus TAR now in Stock at their Gas-Works, amounting to about 140 Tons, more or less; to be delivered into Purchaser's Tank-Waggon at the Haverfordwest Railway Station, or into Steamer or Sailer at the Gas-Works Quay. Delivery to be completed within three months after acceptance of Tender.

Any further Information to be had upon application to the Manager of the Gas-Works, Haverfordwest.

Sealed Tenders, addressed to the undersigned, and endorsed "Tender for Tar," to be delivered at the Town Clerk's Office, not later than Thursday, the 18th of May next.

The highest or any Tender not necessarily accepted.

R. T. P. WILLIAMS,
Town Clerk.

Council Chambers, Haverfordwest,
May 5, 1899.

RHYL URBAN DISTRICT COUNCIL.

(GAS DEPARTMENT.)

THE Gas Committee of the Rhyl Urban District Council invite TENDERS for the supply of 4000 Tons of best screened GAS COAL for One Year, from the 1st of July, 1899, to be delivered f.o.r. Rhyl, in such monthly quantities as may be required.

Further Information and Forms of Tender may be obtained from Mr. Leonard G. Hall, Gas Engineer and Manager.

Sealed Tenders, endorsed "Tender for Coal," to be addressed to the Chairman of the Gas Committee, Clwyd Street Offices, Rhyl, on or before the 30th of May, 1899.

The Committee do not bind themselves to accept the lowest Tender.

ARTHUR ROWLANDS,
Clerk to the Council.

Council Office, Rhyl,
May 6, 1899.

STOKE-UPON-TRENT CORPORATION GAS-WORKS.

NEW RETORT-HOUSE, &c.

THE Gas Committee invite Tenders for the erection of a new RETORT-HOUSE, including Foundations, Arches, Brickwork, and Mountings for five through Beds of Retorts on the Regenerator Principle.

Plans and Specifications may be seen (or copies obtained on payment of 10s. 6d.), and other Particulars obtained from the undersigned, at the Gas-Works Offices, Wharf Street, Stoke-on-Trent.

Sealed Tenders must be addressed, F. Geen, Esq., J.P., Chairman of Gas Committee, and delivered not later than noon, May 18, endorsed "Tender for Retort-House."

The Committee do not bind themselves to accept the lowest or any Tender; but if a Tender is accepted, the time specified by the Tenderer for the completion of the work will be taken into consideration.

WM. PRINCE,
Engineer and Manager.

CORPORATION OF WALSALL.

TENDERS FOR GAS COAL.

THE Corporation of Walsall invite TENDERS for the supply of 40,000 Tons of STAVELEY, YORKSHIRE, or any other good GAS COAL, and 5000 Tons of screened GAS NUTS, to be delivered during One Year from the 1st of July next, at the Corporation Siding at the Pleck Gas-Works, Walsall, as may be required.

Forms of Tender and Specification may be obtained on application to the undersigned.

The Corporation do not bind themselves to accept any Tender; and they reserve the right to divide the Contract between several firms.

Tenders, sealed and marked outside "Tender for Gas Coal," and stating the price for large Coal and also for Nuts, are to be sent to the undersigned on or before Saturday, the 27th of May inst.

JOHN R. COOPER,
Town Clerk.

Borough Offices, Walsall,
May 6, 1899.

TO LIME MASTERS.

THE Corporation of Walsall invite TENDERS for the supply of about 800 Tons of LIME, which will be required at their Gas-Works during One Year from the 1st of July next; the deliveries to be in such monthly quantities as the Manager of the Gas-Works may from time to time direct.

The Lime is to be Hand-picked, and clear from Refuse and Ashes, and to be delivered at the Corporation Siding at the Pleck Gas-Works as required.

Payments monthly.

Tenders, sealed and marked outside "Tender for Lime," are to be sent to the undersigned on or before Saturday, the 27th of May inst.

JOHN R. COOPER,
Town Clerk.

Borough Offices, Walsall,
May 6, 1899.

COUNTY BOROUGH OF WEST BROMWICH.

THE Gas Committee of the Corporation invite TENDERS for the following PLANT and APPARATUS required at their Albion Gas-Works.

PURIFIERS—For the construction of additional Purifiers, with Valves, Connections, &c., complete.

STATION METER—For the building of a Station Meter, of a capacity of 60,000 cubic feet per hour. Designs to accompany the Tender.

Drawings and Specifications may be seen, and other Information obtained, upon application to the Manager (Mr. Thos. Glover) at the Gas-Works.

The Gas Committee do not bind themselves to accept the lowest or any Tender.

Tenders, suitably endorsed, must be delivered to me at this address not later than Thursday, the 18th of May, 1899.

By order,
THOMAS HUDSON,
Secretary.

Town Hall, West Bromwich,
April 26, 1899.

PAIGNTON GAS COMPANY.

TENDERS FOR GAS COAL.

THE Directors of the Paignton Gas Company are prepared to receive TENDERS for the supply, for One, Two, or Three Years, of about 3700 Tons per annum of best approved GAS COALS, in such monthly quantities as may be required by the Company.

Tenders to state the price of the Coal, delivered at Paignton Station, Great Western Railway, free of all charges.

The Directors do not bind themselves to accept the lowest or any Tender.

Further Particulars may be obtained on application to Mr. C. G. Dawson, the Company's Manager.

Sealed Tenders, endorsed "Tender for Coal," specifying the description and quality of the Coal, to be sent on or before the 16th of May, addressed to the undersigned, Gas Offices, 5, Victoria Street, Paignton.

F. W. PUDDICOMBE,
Secretary.

Paignton, May 1, 1899.

HINCKLEY URBAN DISTRICT COUNCIL.

(GAS DEPARTMENT.)

THE above Council invite Tenders as follows:—

COAL—For the supply of 5000 Tons of Gas Coal during the Year ending June 30, 1900.

LIME—For the supply of 250 Tons of Lime for Purification Purposes, during the Year ending June 30, 1900.

SULPHURIC ACID—For the supply of 50 Tons of Sulphuric Acid during the Year ending June 30, 1900.

TAR—For the purchase of the surplus Tar (about 300 Tons) produced at their Gas-Works during the Year ending June 30, 1900.

Forms of Tender and further Particulars may be obtained on application to Mr. Lee, Gas-Works, Hinckley.

Sealed and endorsed Tenders to be sent to the undersigned not later than Saturday, the 13th of May, 1899.

The Council do not bind themselves to accept the lowest or any Tender.

By order,
JOHN W. PRESTON,
Clerk.

Hinckley, April 29, 1899.

GOOLE URBAN DISTRICT COUNCIL.

(GAS AND WATER DEPARTMENT.)

THE Goole Urban District Council are prepared to receive TENDERS for the following, supplied and erected complete at their Doyle Street Gas-Works, Goole:—

Three Beds of Six D RETORTS (Regenerator Principle), complete, with Subway, Lift, and Retort Mountings.

STEEL GIRDERS and other IRONWORK for Covering in Tar and Liquor Underground Tanks.

CAST-IRON COLUMNS and STEEL GIRDERS for alterations to Retort-House.

Drawings, Specifications, &c., may be seen at the Engineer's Office, Gas-Works, Goole.

Sealed Tenders, endorsed "Tender for Retort-Bench," "Girders, &c., for Tar-Tank," or "Retort-House Columns and Girders," to be addressed to Geo. England, Esq., Clerk to the Council, Exchange Buildings, Goole, not later than Twelve o'clock noon, on Monday, the 22nd day of May, 1899.

The Council do not bind themselves to accept the lowest or any Tender.

By order,
MATT. DUNN, M.Inst.Mech.E.,
Engineer and Manager.

Gas Works, Goole,
May 4, 1899.

LIVERPOOL UNITED GASLIGHT COMPANY.

TENDERS FOR CANNEL AND COAL.

THE Directors of the Liverpool United Gaslight Company are prepared to receive TENDERS for the supply of 100,000 Tons of CANNEL and 130,000 Tons of COAL, to be delivered at the various Works of the Company during the period of Twelve Months between the 1st of July, 1899, and the 30th of June, 1900.

Tenders may also be made for similar supplies during the Year commencing the 1st of July, 1900.

Tenders will be received for the whole or any portion of the above quantity.

The Directors reserve the right to accept Tenders for the whole or any portion of any quantity offered, and do not bind themselves to accept the lowest or any Tender.

Full Particulars and Printed Forms of Tender can be obtained, on application to the undersigned, at the Gas Office, Duke Street, Liverpool, to whom Tenders (on the printed form only) must be delivered at or before Ten a.m., on Thursday, May 18, endorsed "Tender for Cannel and Coal."

By order,
WILLIAM KING,
Engineer.

Gas Office, Duke Street, Liverpool,
April 26, 1899.

TENDERS FOR GAS COAL.

THE Directors of the Gosport Gas and Coke Company invite TENDERS for the supply of 9000 Tons of good unscreened fresh wrought GAS COAL, to be delivered within the ensuing Twelve Months in such quantities as may be required, into Barges in Portsmouth Harbour, or in Barges alongside the Works, or at Gosport Railway Terminus.

Tenders, stating kind of Coal offered, to be addressed to the Chairman, and endorsed "Tender for Coal," to be delivered by the 17th of May, 1899.

The Directors do not bind themselves to accept any Tender.

G. B. IRONS,
Secretary and Superintendent.

Gosport, May 4, 1899.

BOROUGH OF BURTON-UPON-TRENT.

TO COLLIERY PROPRIETORS.

THE Mayor, Aldermen, and Burgesses of the Borough of Burton-upon-Trent, acting by the Council, are prepared to receive TENDERS from Colliery Proprietors for the supply of 25,000 Tons of best screened GAS COAL and 5000 Tons of CANNEL or portions thereof.

Forms of Tender and Conditions of Supply may be obtained upon application at my Office; and sealed Tenders, endorsed "Coal," are to be delivered to me at or before Ten a.m., on Thursday, the 25th day of May inst.

The Council do not bind themselves to accept the lowest or any Tender.

F. L. RAMSDEN,
Manager and Engineer.

Gas and Electric Light Works,
Wetmore Road, Burton-upon-Trent,
May 2, 1899.

SCARBOROUGH GAS COMPANY.

AMMONIACAL LIQUOR.

THE Directors of the Scarborough Gas Company invite TENDERS for the whole of the AMMONIACAL LIQUOR, to be produced at their Works for One or more Years from the 1st day of July next.

Tenders may be submitted either at a fixed Price per Ton or on a Sliding-Scale, regulated by the price of Sulphate. Preference will, however, be given to the latter.

Further Particulars may be obtained on application to the undersigned.

Tenders (duly endorsed) must be delivered, addressed to the Chairman of the Company, not later than Noon, on Saturday, the 10th of June next.

The Directors do not bind themselves to accept the highest or any Tender.

By order,
J. HOLLIDAY,
Engineer and Secretary.

Gas Offices: 32, Westborough,
Scarborough, May 17, 1899.

COUNTY BOROUGH OF BURY.

(GAS DEPARTMENT.)

THE Gas Committee invite Tenders for the SUPPLY and delivery at their Gas Siding, Bury, of Twenty 10-TON COAL-WAGGONS, fitted at one end with End Tipping-Doors, the same to be in strict conformity with the Rules and Regulations of the Board of Trade; and, upon the delivery of same, the Contractor or Contractors to furnish the Gas Committee with a Certificate to the effect that such Conditions have been complied with.

Also for the PURCHASE of Twenty 8-TON COAL-WAGGONS (now in use), which may be seen on application to Mr. H. Simmonds, Engineer and Manager, Gas-Works, Bury.

Sealed Tenders, endorsed "New Coal-Waggons," and accompanied by Specification and Drawing of same, also Tenders endorsed "Old Coal-Waggons," to be delivered to the undersigned on or before Tuesday, the 16th inst.

JOHN HASLAM,
Town Clerk.

Corporation Offices, Bank Street,
Bury, May 4, 1899.

VESTRY OF PADDINGTON.

(PUBLIC LIGHTING DEPARTMENT.)

TO GAS-METER MANUFACTURERS AND OTHERS.

THE Vestry of the Parish of Paddington are prepared to receive TENDERS for the following Works—viz., The REPAIR and ADJUSTMENT from time to time of certain WET LAMP METERS and CAST-IRON METER-BOXES (about 100 in number); also the REPAIRING, ADJUSTING, and TESTING from time to time of certain COCKS, GOVERNORS, and BURNERS (about 1980 in number).

The Contract to be for One, Three, or Five Years.

Printed Forms of Tender may be had at the Vestry Hall; and further Particulars obtained on application to the Surveyor, between the hours of Ten a.m. and Four p.m., Saturdays Ten a.m. to One p.m.

No Tender will be accepted unless made on one of the printed forms.

The Tenders to be sealed and delivered at the Vestry Hall, Harrow Road, before Twelve o'clock noon, on Monday, the 15th of May, 1899, after which no Tender will be received.

At the same time a £10 Bank of England note (not to be enclosed with the Tender) must be lodged with the Vestry Clerk as evidence that the Tender is made *bonâ-fide*; the same to be returned immediately to parties whose Tenders are rejected, but in the case of the party whose Tender is accepted to be retained until the contract is signed. If the Tender be withdrawn after its acceptance by the Vestry, the deposit will become forfeited.

The Vestry do not bind themselves to accept the lowest or any Tender.

By order,
FRANK DETHRIDGE,
Vestry Clerk.

Vestry Hall, Harrow Road,
London, W., May 2, 1899.

TENDERS FOR GAS COALS.

THE Directors of the Wakefield Gaslight Company invite TENDERS for GAS COALS, for the period ending June 30, 1900.

Forms of Tender and further Particulars can be obtained on application to the undersigned, to whom Tenders, addressed to the Chairman and Directors, and endorsed "Tender for Coals," must be sent on or before Saturday, May 13, 1899.

H. TOWNSEND,
Engineer and Manager.

Gas-Works, Vicarage Street,
Wakefield.

TENBY GAS CONSUMERS' COMPANY, LIMITED.

CONTRACT FOR TAR AND LIQUOR.

THE Directors of the above Company invite TENDERS for the TAR and AMMONIACAL LIQUOR produced at their Works at Tenby during one or more years.

Particulars as to quantities may be obtained from the undersigned.

Tenders, endorsed "Tender for Tar, &c.," addressed to the Secretary of the Company, C. W. B. Stokes, Esq., to be sent in on or before the 24th inst.

ALFRED H. BROOKMAN,
Engineer and Manager.

Gas-Works, Tenby,
May 5, 1899.

BOROUGH OF WARRINGTON.

(GAS DEPARTMENT.)

TENDERS FOR COAL.

THE Gas Committee of the above Borough invite TENDERS for the supply of 22,000 Tons of COAL.

Full Particulars can be obtained on application to Mr. W. S. Haddock, Engineer.

Sealed Tenders, endorsed "Tender for Coal," addressed to the Chairman, Gas Committee, Gas Offices, Warrington, to be sent in not later than Thursday, the 18th inst.

F. TAYLOR,
Secretary.

Gas Offices, Warrington,
May 6, 1899.

DARWEN CORPORATION.

(GAS DEPARTMENT.)

THE Gas Committee of the above Corporation are prepared to receive TENDERS for the supply of—

1.—Oil and Paints.
2.—Vitriol.
3.—Wrought-Iron Tubes and Fittings.
4.—Cast-Iron Main Pipes and Specials.
5.—Lead Pipe.

for One Year ending the 31st of May, 1900.

All Information may be obtained on application to Mr. A. H. Smith, Engineer and Manager, Gas-Works, Darwen.

Sealed and endorsed Tenders to be delivered to the undersigned not later than Twelve o'clock noon, on the 23th of May, 1899.

By order,
CHAS. COSTEKER,
Town Clerk.

Town Clerk's Office, Darwen,
May 6, 1899.

BOROUGH OF DARLINGTON.

TO COLLIERY PROPRIETORS.

THE Gas-Works Committee of the Darlington Corporation invite TENDERS for the supply of 30,000 Tons, or thereabouts, of SCREENED GAS COAL, delivered at their Gas-Works Railway Siding, during Twelve months commencing the 1st of July next, in such quantities as may be from time to time required by the Gas-Works Engineer.

The Coal proposed to be supplied must be of the best description for Gas Making, free from all Impurities, and to the satisfaction of the Gas-Works Engineer.

The Committee reserve the right of accepting a Tender for the whole or any portion of the quantity of Coal tendered for.

Tenders, endorsed "Tender for Gas Coal," and addressed to the Chairman of the Gas-Works Committee, Town Hall, Darlington, must be sent in not later than the 18th inst.

No pledge is given that the lowest or any Tender will be accepted.

HY. G. STEAVENSON,
Town Clerk.

Darlington,
May 5, 1899.

WALLASEY URBAN DISTRICT COUNCIL.

TO MAKERS OF GAS PLANT.

THE above Council are prepared to receive TENDERS for the Supply, Delivery, and Erection of One TAR-EXTRACTOR and SCRUBBER-WASHER, to pass 1,500,000 cubic feet of Gas in 24 hours.

Plans may be inspected, and a Copy of the Specification obtained, on application to the Engineer, Mr. J. H. Crowther, at his Offices, Great Float, Poulton, near Birkenhead, on payment of a sum of £2, which amount will be returned on receipt of a *bonâ-fide* Tender.

Sealed Tenders, on the form provided for the purpose, addressed to me, as below, and endorsed "Gas, &c., Committee, Tender for Tar-Extractor and Scrubber-Washer," to be delivered per post not later than Four o'clock in the afternoon of Thursday, the 18th inst. Tenders arriving after that time will not be considered.

The Contractor will be required to enter into a bond, with approved sureties, for the due performance of the Contract.

The Council do not bind themselves to accept the lowest or any Tender.

By order,
H. W. COOK,
Clerk to the Council.

Public Offices, Egremont, Cheshire,
May 5, 1899.

TENDERS invited for small Kirkham, Hulett, and Chandler's "STANDARD" WASHER-SCRUBBER, Four PURIFIERS, and other PLANT. To be sold together or separately. May be seen on application to the Manager, Gas-Works, Barking, Essex.

Tenders should be addressed to the SECRETARY 55-56, High Holborn, LONDON, W.C.

THE Directors of the Camborne Gas Company, Limited, invite TENDERS for 1000 Tons of GAS COAL, delivered f.o.b. to their order before June, 1900.

Tenders should be sent to the undersigned on or before the 17th inst.

The Lowest Tender will not necessarily be accepted.

W. BAILEY,
Secretary.

Dated Camborne, May 6, 1899.

FENTON URBAN DISTRICT COUNCIL.

(GAS DEPARTMENT.)

TAR AND LIQUOR.

THE Gas Committee invite Tenders for the purchase of the surplus TAR and AMMONIACAL LIQUOR to be produced at their Works for Twelve Months ending June 30, 1900.

Particulars may be obtained from the undersigned.

Sealed and endorsed Tenders, addressed to the Chairman, Gas-Works, Fenton, to be forwarded on or before May 15 next.

F. H. DARWIN,
Manager and Secretary.

Gas Offices, Fenton,
April 26, 1899.

NORMANTON GAS COMPANY.

TENDERS FOR GAS COAL.

THE Directors of the above Company invite TENDERS for 4000 Tons of GAS COAL, to be delivered during the Year ending June 30, 1900, at Normanton Station.

There is no Special Form of Tender.

Tenders to be sent in to the undersigned on or before Saturday, the 13th inst.

The Directors do not bind themselves to accept the lowest or any Tender.

E. H. HUDSON,
Secretary.

Gas-Works, Normanton,
May 6, 1899.

MARKET HARBOROUGH URBAN DISTRICT COUNCIL.

(GAS DEPARTMENT.)

THE Gas Committee of the above invite TENDERS for the following to be supplied during the ensuing Twelve Months:—

3000 Tons of GAS COAL.
30 „ SULPHURIC ACID.
60 „ CRECH LIME.

Deliveries to commence July next.

Tender Forms and Particulars on application.

Also TENDERS for TAR for same period.

Sealed and endorsed Tenders to the undersigned by May 15.

By order,
J. FRYER,
Manager.

Gas Offices, Market Harborough,
May 4, 1899.

SHREWSBURY GASLIGHT COMPANY.

TENDERS FOR COAL.

THE Directors of the Shrewsbury Gaslight Company invite TENDERS for the supply of about 13,000 Tons of screened GAS COALS, to be delivered free at the Great Western or London and North-Western Goods Yard, Shrewsbury, during the Year commencing July 1, 1899, and ending June 30, 1900.

The Directors reserve to themselves the right to divide the quantity into two or more Contracts, and do not bind themselves to accept the lowest or any Tender.

Tenders must be made on Forms (containing further Particulars) which may be obtained on application at the Company's Works, or by post, and must be sent to the undersigned, on or before the 9th day of May, 1899

By order,
WM. BELTON, Assoc.M.Inst.C.E.,
Secretary and Manager.

Gas-Works, Shrewsbury,
April 26, 1899.

MANSFIELD CORPORATION.

(GAS DEPARTMENT.)

TENDERS FOR GAS COAL AND CANNEL.
TENDERS FOR TAR AND AMMONIACAL LIQUOR.

COAL.

THE Gas Committee are prepared to receive TENDERS for 2000 Tons of CANNEL and 7000 Tons of best screened GAS COAL, delivered at Mansfield Station, for One Year, from the 1st of June, 1899, to the 31st of May, 1900.

TAR AND LIQUOR.

Tenders for surplus TAR and LIQUOR made during the Year, from the 1st of July, 1899, to the 30th of June, 1900. Tenders for Liquor to be made either at a fixed price per Ton or on the Sliding-Scale regulated by the price of Sulphate.

Tenders, endorsed, to be sent to J. Harrop White, Esq., Deputy Town Clerk, Mansfield, on or before the 27th of May, 1899.

Particulars and all other Information from the undersigned.

No special Form of Tender provided.

The Committee do not bind themselves to accept the lowest or any Tender.

ARTHUR GRAHAM,
Engineer and Manager.

Gas-Works, Mansfield,
May 6, 1899.

The Application Lists will be opened on Monday, the 15th day of May, 1899, and will be closed on Tuesday, the 16th.

C. & W. WALKER, LIMITED,

Midland Iron-Works, Donnington, near Newport, Shropshire,

And 110, CANNON STREET, LONDON, E.C.

Incorporated under the Companies' Acts, 1862 *to* 1898.

CAPITAL - - £100,000,

DIVIDED INTO

10,000 Five-and-a-half per Cent. Cumulative Preference Shares of £5 each ..	£50,000
10,000 Ordinary Shares of £5 each	£50,000
	£100,000

PRESENT ISSUE—

8000 Five-and-a-half per Cent. Cumulative Preference Shares of £5 each ..	£40,000
8000 Ordinary Shares of £5 each	£40,000
	£80,000

There is also an issue of £20,000 Four per Cent. Mortgage Debentures, the whole of which will be taken by the Executors of the late Charles Clement Walker, who are the Vendors to the Company, and will be repayable by ten equal instalments of £2000 a year, commencing on the 31st January, 1904, or after that date at the option of the Company after giving six months' notice.

The Preference Shares will be entitled to a fixed Cumulative Preferential Dividend of Five Pounds Ten Shillings per cent. per annum, and will rank both as regards Dividend and Capital in priority to the Ordinary Shares, but will not be entitled to any further participation in profits or assets.

Preference Shares to the value of £12,500, and Ordinary Shares to the value of £15,000 have been applied for privately by the Managing-Director, Mr. Featherstone, and his friends; and he has stipulated that that number at least shall be allotted to him and such friends.

The balance of the Preference and Ordinary Shares are offered for Subscription payable as follows:—

PREFERENCE AND ORDINARY SHARES £1 PER SHARE ON APPLICATION.
" " " " £2 PER SHARE ON ALLOTMENT.
" " " " £2 PER SHARE IN ONE MONTH AFTER ALLOTMENT.

DIRECTORS.

JOHN FREDERIC WRIGHT (Managing-Director of JOHN WRIGHT & Co., LTD., Birmingham), Chairman.

WILLIAM PERROTT (Managing-Director LILLESHALL IRON COMPANY, LTD.), Priors Lee Hall, Shifnal, Salop.

CHARLES HENRY WRIGHT (Director EAST CANNOCK COLLIERY COMPANY, LTD.), Tillington Hall, Stafford.

ALFRED FEATHERSTONE (who has been for eight years General Manager for Messrs. C. & W. WALKER), Managing-Director.

BANKERS.

LLOYDS BANK, LIMITED, Birmingham and Branches.

AUDITORS.

CALDICOTT, HILL, & HARRISON, 10, Newhall Street, Birmingham.

SOLICITORS (To the Vendors).

JOHNSONS, BARCLAY, AND ROGERS, 36, Waterloo Street, Birmingham.

SOLICITOR (To the Company).

H. G. U. ELLIOTT, Newport, Salop.

SECRETARY.

WILLIAM COTTRELL.

Registered Offices.

DONNINGTON, NEWPORT, SALOP.

ABRIDGED PROSPECTUS.

This Company has been formed to acquire as a going concern as from the 31st January, 1899, the business of Gas Engineers, Gas Plant Manufacturers, and General Engineers, which has been successfully carried on by the late Charles Clement Walker and the late William Thomas Walker under the style of "C. & W. Walker, Midland Iron-Works," at Donnington, near Newport, in the County of Salop, for upwards of 40 years.

The total number of persons employed in the Works is about 700. At the present time, the whole of the Departments are fully employed; Contracts are on hand sufficient to keep the Works in full swing for the next four months; and fresh Contracts are constantly being secured.

Mr. Alfred Featherstone, who has been in the service of the Firm for 25 years, and under whose management for the last eight years

the Firm has been successfully carried on, has entered into an Agreement to remain as Managing-Director for the term of seven years.

Mr. Alexander Smith, M.Inst.C.E., of Birmingham, the well-known Valuer, values the assets, exclusive of Goodwill, at £75,404 5s. 6d. The goodwill, based on the average profit of the last two years, stands at only one-and-a-half year's purchase.

The following is a copy of his Valuation.

To the Directors of C. & W. WALKER, LIMITED.

Birmingham, May 4th, 1899.

"Gentlemen,—For eleven years I have annually valued Messrs. C. & W. Walker's Leasehold Works at Donnington, for the purpose of Stock Taking; and the following figures are based upon the valuation made January 31st last. As very adequate depreciation has always been provided, I have no hesitation in saying the Valuation is a low one:—

Buildings, Erections, Cottages, Fixed Plant and Machinery	£30,666	18	9
Loose Plant and Tools, Stocks and Stores	30,509	17	2
Work in progress upon Contracts in hand (as per Works Account) with Establishment Charges ..	14,227	9	7
	£75,404	5	6

This is exclusive of any estimate of goodwill, book debts, or improved value of bought or sold contracts.

The Works are situated, in close proximity to the Shropshire Coal-Field, at Donnington Station of the London and North-Western Railway; and are replete with good, sound Machinery, Steam Cranes, and Hydraulic Plants.

There is a complete Gas Plant for supplying the Works. There are also admirable Mess Rooms, Baths, and Cycle Stores for the comfort and convenience of the workmen.

Yours sincerely,
ALEXANDER SMITH."

Messrs. Caldicott, Hill, and Harrison, who have audited the Accounts of the Firm for the past 20 years, certify that the average annual net profit for the last 10 years has been £8038 6s. 3d., and that the profits for the years 1897 and 1898 have been £9226 17s. 0d. and £10,479 14s. 11d. respectively.

The following is a copy of the Accountants' Certificate.

To the Directors of C. & W. WALKER, LIMITED.

10, *Newhall Street, Birmingham, May 4th*, 1899.

"We have for the past 20 years regularly audited the Accounts of Messrs. C. & W. Walker, of the Midland Iron-Works, Donnington, Shropshire, and certify that for the ten years ending 31st January, 1899, their total Profits amounted to £80,383 2s. 6d., being an average of £8038 6s. 3d. per annum, and that the Profits for the last two years of this period have been £9226 17s. 0d. and £10,479 14s. 11d. respectively.

Before arriving at these Profits, the whole of the Works with the fixed and loose Plant and the Stock were valued yearly by Mr. Alexander Smith, M.Inst.C.E., who has made adequate allowance for depreciation.

All Bonuses to the Manager and Members of the Staff have also been defrayed.

CALDICOTT, HILL, & HARRISON,
Chartered Accountants."

On the basis of the net profit of last year—namely, £10,479 14s. 11d.—the figures work out as follows:—

To pay interest on Debentures	£800	0	0
To pay a Dividend of 5½ per cent. on the Preference Shares ..	2,200	0	0
To pay a Dividend of 8 per cent. on the Ordinary Shares ..	3,200	0	0
	6,200	0	0
Leaving available for Directors' Fees, Reserves, and further Dividend	4,279	14	11
	£10,479	14	11

The orders booked for the first three months of this financial year are in excess of those of last year.

By the first agreement hereinafter mentioned, the Executors have agreed to sell to the Company as from January 31st, 1899, the business (free from all trade liabilities, but less the Book debts due on that date), and the whole of the Leasehold Land, Buildings, Plant, Machinery, Stock-in-Trade, Tools, Stores, &c., together with the Goodwill, Patents, Licenses, &c., and the benefit of trading since January 31st, 1899, for the sum of £75,000. They are also to receive Interest at the rate of 4 per cent. per annum on £20,000, and at the rate of 5 per cent. per annum on the Balance from the 31st January, 1899, to the date of completion. By the second agreement hereafter mentioned, the Company have arranged with Mr. Featherstone, who has successfully carried on the business for the last eight years, to pay him a sum of £6500 on his entering into an agreement with the Company to remain as Managing-Director for the term of seven years. By the third agreement, the sum of £8500 is to be paid for the whole of the expenses (except stamps) relating to the floating of the Company up to allotment, and for the guaranteeing and raising of the capital. The present issue provides a Working Capital of £10,000, which, in the opinion of Mr. Featherstone, is sufficient to provide for all requirements at present; and, in addition, there is an unissued Capital of £20,000.

The following contracts have been entered into: (1) Dated the 4th day of May, 1899, and made between Katherina Walker and George James Johnson, the Executors of the late C. C. Walker of the one part and the Company of the other part; (2) Dated the 4th day of May, 1899, and made between Alfred Featherstone of the one part and the Company of the other part; (3) Dated the 4th day of May, 1899, and made between the Company of the one part and George Ernest Wright of the other part. There are necessarily many Agreements relating to the business, which for trade reasons cannot be advantageously specified, but which may constitute contracts within the meaning of the 38th section of the Companies' Act, 1867. Applicants for shares will be deemed to have had for all purposes full notice of all such agreements and arrangements; and applications will be received only upon the footing that the applicants are to be deemed to agree with the Company (as Trustees for the Directors, Vendors, and other persons liable) to waive further particulars of any such agreements and arrangements and also any claims such applicants may have owing to any want of full compliance with the requirements of Section 38 above referred to in relation to such contracts, agreements, and arrangements.

Copies of the full Prospectus may be obtained on application to the Secretary of the Company, Midland Iron-Works, Donnington, Newport, Salop.

Applications for Shares should be made upon the accompanying forms, and forwarded to the Bankers of the Company with the amount payable on application. If no allotment is made, the deposit will be returned in full; and where the number of shares allotted is less than the number applied for, the surplus will be credited in reduction of the amount payable on allotment.

12th May, 1899.

C. & W. WALKER, LIMITED.

No.....

FORM OF APPLICATION FOR ORDINARY SHARES.

TO THE DIRECTORS OF C. & W. WALKER, LIMITED.

Gentlemen,—Having paid to the Company's Bankers the sum of £.....being a deposit of £1 per Share on application for.....Ordinary Shares of £5 each in the above Company, I request you to allot me that number of Shares upon the terms of the Prospectus, and I hereby agree to accept the same or any less number, and I authorize you to place my name upon the Register of Members in respect of the Shares so allotted to me, and I agree to pay the further instalments upon such allotted shares as required by the terms of such Prospectus, and I also agree with the Company, as Trustee for the Directors and other Persons liable, to waive any claim I may have against them for not more fully complying in the said Prospectus with the requirements of Section 38 of the Companies' Act, 1867.

NOTE. PLEASE WRITE VERY DISTINCTLY.

Ordinary Signature.....
Name (in full) (Mr., Mrs. or Miss).....
Address (in full).....
Profession or Business.....
Date.....1899.

C. & W. WALKER, LIMITED.

No.....

FORM OF APPLICATION FOR PREFERENCE SHARES.

TO THE DIRECTORS OF C. & W. WALKER, LIMITED.

Gentlemen,—Having paid to the Company's Bankers the sum of £.....being a deposit of £1 per share on application for.....Preference Shares of £5 each in the above Company, I request you to allot me that number of Shares upon the terms of the Prospectus, and I hereby agree to accept the same or any less number, and I authorize you to place my name upon the Register of Members in respect of the Shares so allotted to me, and I agree to pay the further instalments upon such allotted Shares as required by the terms of such Prospectus, and I also agree with the Company, as Trustee for the Directors and other persons liable, to waive any claim I may have against them for not more fully complying in the said Prospectus with the requirements of Section 38 of the Companies' Act, 1867.

NOTE. PLEASE WRITE VERY DISTINCTLY.

Ordinary Signature.....
Name (in full) (Mr., Mrs. or Miss).....
Address (in full).....
Profession or Business.....
Date.....1899

ST. ANNE'S-ON-THE-SEA GAS COMPANY.

THE Directors are prepared to receive TENDERS for the supply of best screened GAS COAL required for the Year ending June 30, 1900.

Forms of Tender may be had on application.

Tenders, endorsed "Coal," and addressed to the Chairman, must be delivered at the Company's Offices not later than Thursday, May 18, 1899.

WILLIAM H. NUTTER,
Secretary and Manager.

Gas Offices, St. Anne's-on-the-Sea,
May 2, 1899.

BOROUGH OF PETONE, NEW ZEALAND.

TO GAS ENGINEERS, MANUFACTURERS, AND CONTRACTORS.

THE Petone Borough Council invite TENDERS for the supply and delivery at the Port of Wellington, New Zealand, of the undermentioned Plant and Apparatus for the Manufacture and Distribution of Coal Gas—viz.. RETORT-HOUSE IRONWORK and FIRE-CLAY GOODS, EXHAUSTER, CONDENSER, SCRUBBER, TWO PURIFIERS, STATION METER, 40 feet GASHOLDER, STATION GOVERNOR, 6-inch, 4-inch, and 3-inch Cast-Iron Spigot and Faucet MAIN PIPES, Wrought-Iron TUBES and FITTINGS, LAMP-POSTS, TOOLS, and SUNDRIES.

Plans, Specifications, and Tender Forms may be inspected at the Office of the "JOURNAL," 11, Bolt Court, Fleet Street, London, E.C.

Tenders, sealed and endorsed "Tender for Gas Plant," will be received at the Office of the Borough Council, Petone, Wellington, New Zealand, until Friday, the 30th day of June, 1899.

The Council do not bind themselves to accept the lowest or any Tender, and may accept the whole or any part of a Tender as they may see fit.

R. CLEMENT KIRK,
Mayor.

Petone, March 15, 1899.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his AUCTIONS of STOCKS and SHARES in London, Suburban, and Provincial Gas and Water Companies are held MONTHLY, at the Mart, Tokenhouse Yard, E.C.

He also undertakes the issuing by Auction of Gas and Water Stocks and Shares under Parliamentary Powers.

Terms for issuing such Capital, and also for including Gas and Water Stocks and Shares in these periodical Sales, can be obtained on application at Mr. Alfred Richards's Offices, 18, FINSBURY CIRCUS, E.C.

By order of the Directors.

CATERHAM AND DISTRICT GASLIGHT AND COKE COMPANY, LIMITED.

250 £10 FIVE PER CENT. PREFERENCE SHARES.
(TO BE ISSUED AS FULLY PAID.)

MR. ALFRED RICHARDS will Sell THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, May 30, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Executors of the late Mrs. Catherine Brown, jointly with Mr. Henry Brown.

RAYLEIGH.

FREEHOLD GAS-WORKS.

MR. ALFRED RICHARDS will Sell BY AUCTION, at the Mart, Tokenhouse Yard, E.C., on Tuesday, May 30, at Two o'clock,

THE FREEHOLD GAS-WORKS
OF THE RAYLEIGH GAS COMPANY, AT RAYLEIGH, ESSEX.

Advantageously placed in a central position, within about 350 yards of Rayleigh Station and Goods Yard on the G.E.R., affording excellent facilities for economical carriage of Coal, &c. The Works comprise: RETORT-HOUSES, GASHOLDER, COAL-STORE, CONDENSER, WASHER-SCRUBBER, Three PURIFIERS, STATION METER, GOVERNOR, &c., MANAGER'S HOUSE, OFFICE, and WORKSHOP, together with the DISTRIBUTING PLANT. The whole to be sold as a GOING CONCERN and with POSSESSION on COMPLETION.

May be viewed, and Particulars with Conditions of Sale obtained, of LOXLEY, ELAM, AND GARDNER, Solicitors, 80, CHEAPSIDE, E.C.; of Mr. ROBERT JAMES TWYFORD, Solicitor, 44, FINSBURY PAVEMENT, E.C.; and of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

BOLDON GAS COALS.

ANALYSIS.

Yield of Gas per Ton . .	10,500	Cubic Feet.
Illuminating Power . .	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

For Prices, &c., apply to

W. H. PARKINSON,
THE HARTON COAL CO., LTD.,
NEWCASTLE-ON-TYNE.

Telegraphic Address: "PARKINSON, NEWCASTLE."

IMPERIAL CONTINENTAL GAS ASSOCIATION.

(INCORPORATED BY ACT OF PARLIAMENT.)

NOTICE is Hereby Given, that the HALF-YEARLY ORDINARY GENERAL MEETING of the Proprietors of this Association was held at the City Terminus Hotel, Cannon Street, London, on Tuesday, the 2nd inst.

THOMAS HENRY GOODWIN NEWTON, Esq., in the Chair, when the following RESOLUTIONS were unanimously passed:—

"That the Report of the Directors upon the affairs of the Association be received, adopted, and entered upon the Minutes."

"That a Dividend of 5 per cent. for the Half Year ended the 31st of December last be declared upon the £3,500,000 Capital Stock of the Association, and that the same be payable, free of Income-Tax, on and after the 9th of May next.

"That the Hon. E. C. Leigh, C.B., Q.C., be re-elected a Director of the Association."

"That John Horsley Palmer, Esq., be re-elected a Director of the Association."

"That Robert Tindall, Esq., be re-elected a Director of the Association."

"That Sir Joseph Sebag-Montefiore be re-elected an Auditor of the Association."

The Committee of Proprietors, appointed at the last General Meeting to consider the question of the grant of an Honorarium to the Directors, presented their report, and, in accordance therewith, it was moved by Sir Joseph Sebag-Montefiore, seconded by Mr. J. Gurney Fox, and resolved unanimously:—

"That a sum of Five Thousand Pounds be voted to the Board of Directors of the Association, in recognition of the very important additional labours which they have undergone in connection with the Amsterdam and Vienna Stations, which have been followed by such gratifying success."

Cordial Votes of Thanks were passed to the Directors for their able management of the affairs of the Association, to the Chairman for his conduct in the chair, and to the Staff in London and on the Continent.

By order of the Board,
ROBT. W. WILSON,
Secretary.

21, Austin Friars, London, E.C.,
May 3, 1899.

PATENTS, DESIGNS, AND TRADE MARKS ACTS, 1883—1888.

NOTICE is Hereby Given, that the Welsbach Incandescent Gas-Light Company, Limited, of 14, Palmer Street, London, S.W., have applied for LEAVE TO AMEND THE SPECIFICATION OF THE LETTERS PATENT No. 124, of 1893, granted to Oliver Imray, for "An Improvement in Incandescent Gas-Burners."

Particulars of the proposed Amendments were set forth in the "Illustrated Official Journal (Patents)" issued on the 3rd of May, 1899.

Any person, or persons, may give Notice of Opposition to the Amendment (on Form G), at the Patent Office, 25, Southampton Buildings, London, W.C., within One Calendar Month from the date of the said "Journal."

C. N. DALTON,
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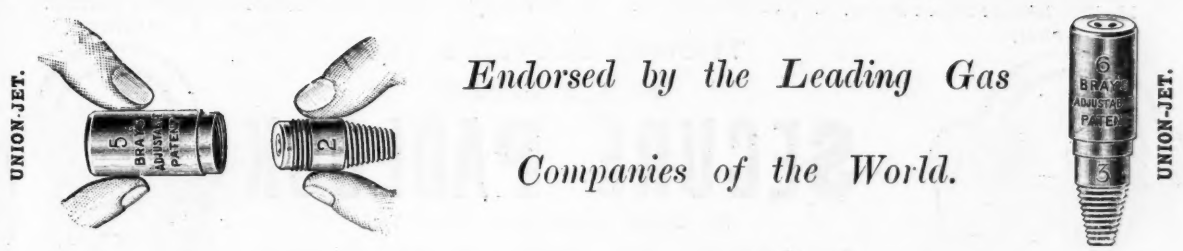

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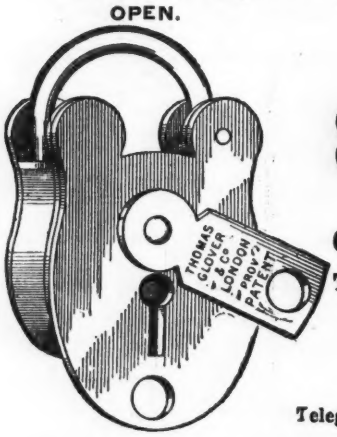

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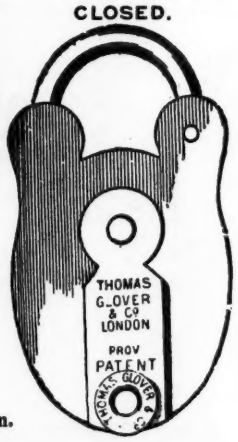

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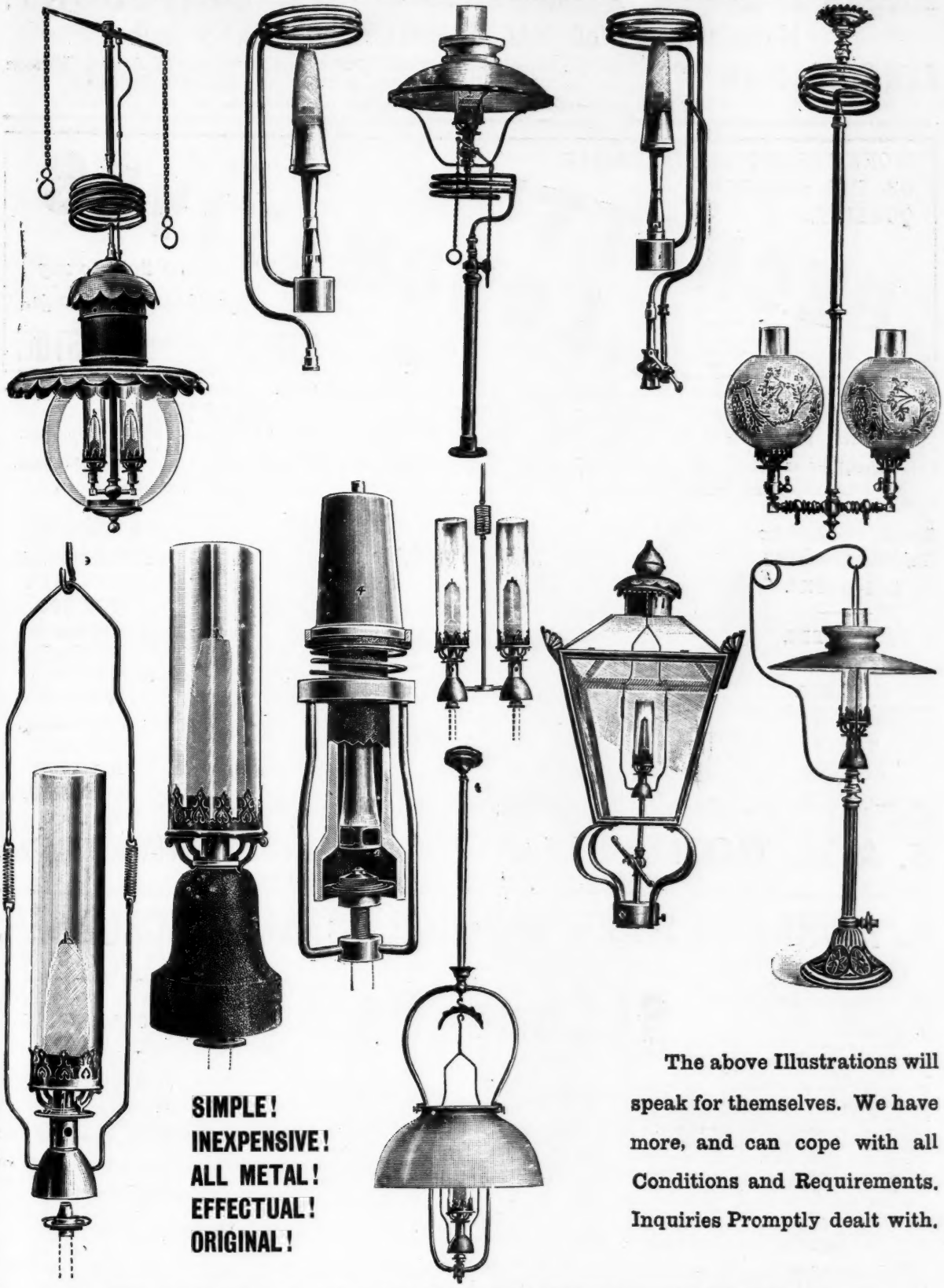

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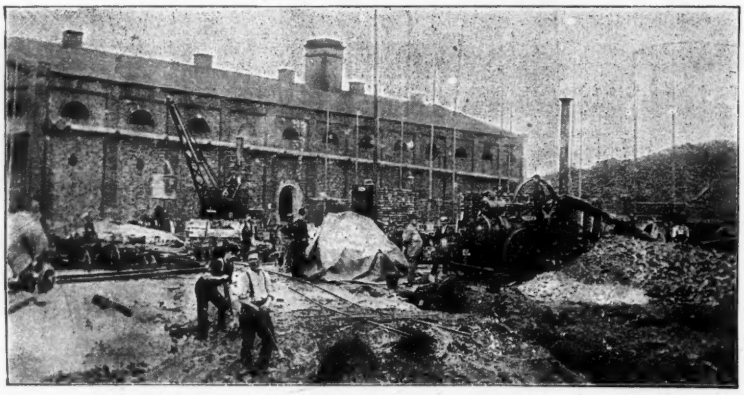

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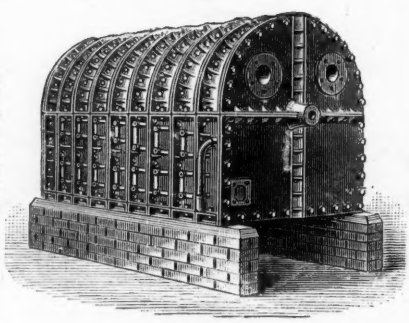

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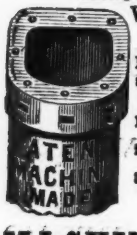

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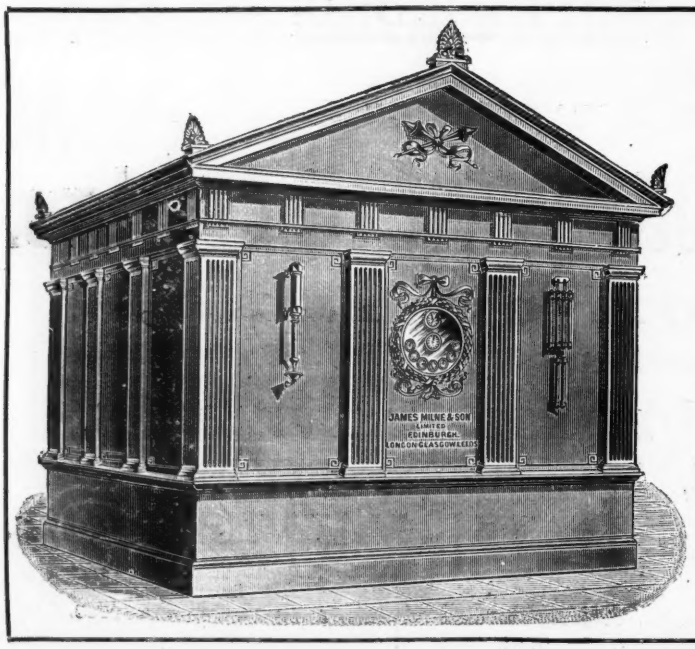

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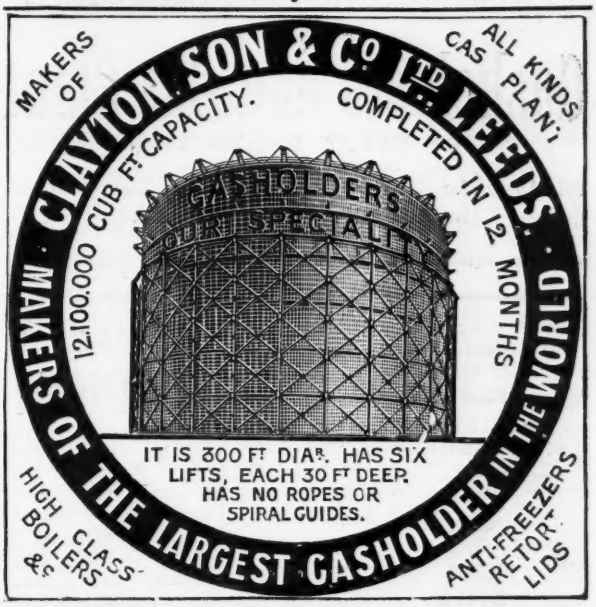
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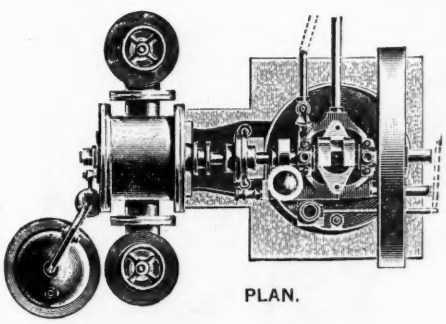
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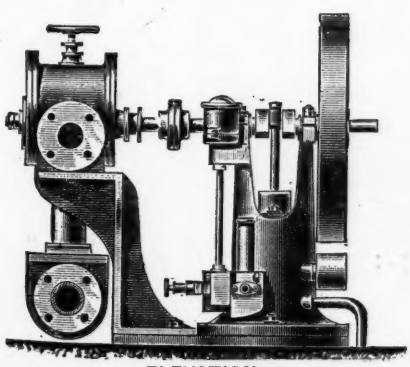
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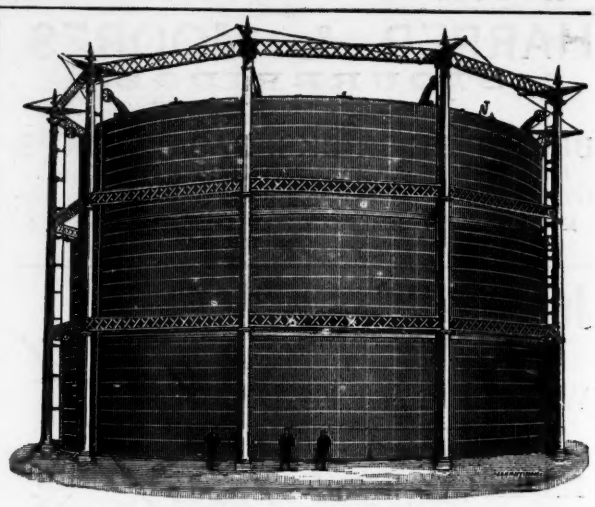

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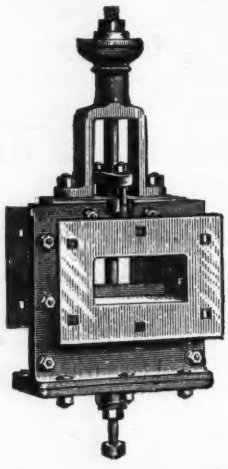

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